PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

DECEMBER 1957

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PLASTICS TECHNOLOGY

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956

"Quote . . . Unquote"

Engineering of Plastic Tooling

"Plastic tooling, still in its infancy, has stirred the creative imagination of the tool engineer to a degree hitherto made impossible by conventional tooling materials. Because of widespread interest and to insure successful future usage of plastic tooling, known limitations must be recognized by the tool engineer in his particular applications. Confidence in a tooling material will only be gained after a long and proven period of successful operation. It is therefore imperative that a realistic approach of limitations be made by sound engineering principles.

"The tooling engineer, having familiarized himself with known properties of raw materials, and basic principles of tool functions, should not expect tool life to exceed maximum inherent physical limits, as imposed by external tool conditions. Discretion as to application and construction of plastic tooling is a must."

William Weaver, President,
Modern Pattern & Plastics, Inc.

Behavior of Reinforced Plastics

"Resin reinforced by glass fibers has become a widely used and a recognized material of construction and its properties have been tested as well as different resins and fiber surface treatments but despite this volume of data, little has been done to examine fundamentally the mechanism of interaction between the resin and the reinforcing material. This alone can show the way to improvement of the properties of the material and pinpoint the research directions that might be attempted in order to obtain properties which might be expected but are now significantly lacking.

"It is generally accepted that the behavior of reinforced plastics is governed by the adhesion between the reinforcing fibers and the resin matrix and that improvements in this adhesion will result in improvements in the properties of the composite material. . . . It will be seen that it is by no means a fully adequate explanation of the mechanism of reinforcement. . . . The adhesion will have little significance after preloading and that the normal pressure of the resin on the fiber after polymerization together with the friction or secondary adhesion may be the most significant factors contributing to its behavior. This secondary adhesion or friction may be several orders of magnitude less than primary adhesion and seems unrelated to it."

Professor J. O. Outwater, Jr.
Mechanical Engineering Dept.,
University of Vermont
Burlington, Vermont

Letters to the Editor

Information Please!

Dear Sir:

The writer would like to manufacture a special radiator shutter for winter automobile driving if the manufactured cost can be held down so that it will sell.

The very first need is finding a low cost material to cover the front of the radiator. As plywood or metal is too stiff and might cause a noise or rattle, a waterproof cardboard, or a ruberoid or plastic might do. If possible, it should be somewhat pliable to conform to any unevenness or ledges around the radiator shell. A corrugated cardboard would almost do, but will sag when wet.

Can you suggest any other good material? Can you also refer me to other good sources who might give me some advice? Your help will be most welcome.

(*Identity Withheld*)

(*Any suggestions from our readers will be forwarded to the inquirer.—Editor*)

• • •

Plastic Credit Cards

Dear Sir:

Will you kindly supply us with a list of firms that print plastic credit cards? Your early attention will be appreciated.

V. J. Winslow
Dashew Business Machines, Inc.
Culver City, Calif.

(*Can our readers help?—Editor*)

• • •

Wants Foamed Polyethylene

Dear Sir:

We are interested in extruded foamed polyethylene, and would be obliged if you would let us have names of suppliers.

Arno Lessheim, Proj. Engr.
Overhead Door Corp.
Hartford City, Ind.

(*Can our readers offer any assistance in this matter?—Editor*)

• • •

Wants Molded Nylon Rings

Dear Sir:

May we ask you to supply us with information as to nylon rings (O.D., approximately 1⅛ inches; I.D. approximately 13/16-inch), both plain as well as brass plated:

(a) What companies manufacture these rings?

(b) What companies plate these rings? A very large quantity is involved.

Thanking you in advance for any information we could get either via your publication or through your readers,

W. A. Modley
ADS Metal Products Co., Inc.
New York, New York

(*Suggestions are requested from our readers for transmittal to Mr. Modley. —Editor*)

• • •

Molders of Wire Connectors

Dear Sir:

We have been referred to you as the best possible source from whom we might obtain the names of molders of electric wire connectors, preferably in this part of the country (East Coast).

We are seeking another molder for more dependable supply and service.

(*Identity Withheld*)

(*Can our readers offer any assistance to the inquirer? We imagine the connectors he seeks are molded of phenolic.—Editor*)

• • •

Vial Information Wanted

Dear Sir:

Do you know who manufactures Tulox vials used for packaging pills?

Your cooperation is appreciated.

I. I. Arnold
Arnold Shoe Products Co.
Boston, Mass.

(*Can our readers provide the answer to this question?—Editor*)

• • •

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

Article Highlights

Design of Molds for Reinforced Plastics. (p. 981)

Written from the mold maker's point of view, this article describes his analysis of a new job, including such factors as mold material, method of cutting the mold, mold benching time and operations, mold heating lines, and mold polishing. Mold design steps, needs of the designers, and the importance of mold components also are discussed.

Hidden Injection Molding Costs. (p. 985)

The computation of injection molding costs is shown to include a wide diversity of obscure expenses. These include material loss from color and grade changes, contamination of material, hygroscopic properties of material, cylinder cleaning, and maintenance of the injection machine.

Adhesive Bonding of Polyethylene. (p. 988)

A chromic acid (potassium dichromate type) pretreatment of all polyethylene parts to be bonded with adhesive is described in detail. Test results are given showing the effects of the treatment on peel strength adhesion of bonds, and the tensile strength of the treated plastic.

Reinforced Plastics in Boat Hull Construction—Part II. (p. 992)

Concluding the two-part article, this section discusses the design criteria for reinforced plastic boat hulls, and the methods for construction of these hulls. A discussion of the future expansion of the FRP boat industry is given, with emphasis on the need for standardization of materials and molding techniques, and the need for performance data on hull forms and constructions.

Previews

The following articles will be published in the January issue:

Mold Design Technology for Polyethylene. R. W. VanSickle, mgr., Plastics Technical Service—South, Dow Chemical Co., Freeport, Texas.

Reinforced Epoxy Spray Masks for Two-Tone Painting. C. B. Martin, pres., Resin Fabricators, Toronto, Ont., Canada.

Plastic Pipe in the Chemical Process Industry. R. B. Seymour, pres., Loven Chemical of Calif., Newhall, Calif.

Significance of Second-Order Transitions of Polyester and Epoxy Resins in Glass Fiber Reinforced Laminates. A. D. Coggeshall, engr., Materials & Processes Lab., Large Steam Turbine-Generator Dept., General Electric Co., Schenectady, N. Y.

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PLASTICS TECHNOLOGY

DECEMBER, 1957

EDITORIAL: Achievement Awards in Plastics Technology

As indicated in our editorial last month, we are looking forward to many improvements and innovations in the magazine in the coming year, our fourth year of growth. Based on many contacts with our readers and the industry, we are certain that these changes will meet with your enthusiastic approval. The only problems they pose in our publication work are essentially those of implementation and execution.

We do have many questions, however, on the feasibility and practicality of a contemplated innovation for which we have no back-log of reader interest—the possible inauguration of a series of Achievement Awards in Plastics Technology. We have been devoting serious consideration of this idea, and our preliminary thinking envisons this series as covering three categories: (1). New developments in plastics processing; (2). New developments in plastics fabricating; and (3). New engineering product applications for plastics.

•

If instituted, we would endeavor to select and publicize in each issue, if possible, a new and outstanding achievement in one or more of these catagories. The selected achievement would be illustrated and described in comprehensive detail, with proper credit to the responsible party behind the development. Naturally, the achievement would be given a prominent position in the magazine, and also would be an entry in a yearly round-up to choose the grand award winner for that year.

The first category, that of new developments in plastics processing, would include all methods whereby a plastic material, as furnished by the materials supplier, can be molded, calendered, or otherwise shaped into a finished or semi-finished form. The second category, new developments in plastics fabricating, would include forming, decorating, assembly, bonding, or other operations to change a semi-finished item into a finished product. The final category, that of engineered plastic products, would cover new applications where the properties of the plastic material, the processing and fabricating operations, and the design and styling of the product were chosen to meet the specific requirements of the individual application.

•

The foregoing is a resume of our thinking to date on the proposed award program, but we cannot ascertain in advance just how practical and feasible the program would be. Can enough entries be obtained? Should grand prize winners be selected by our staff and the Editorial Advisory Board, or should they be chosen by a ballot of our readers? The list of questions is almost endless in number.

We earnestly invite your comments and suggestions on the proposed program. Every reply we receive from you (either as individuals or as spokesmen for your companies) will be given due, sober consideration. We invite your assistance and, in turn, will keep you informed of future developments or changes in the plan. May we hear from you?

Arthur M. Merrill

Editor

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NEWS in BRIEF

Reinforced plastics sales should reach the 168-million pound level by the end of this year, according to a market survey conducted by the Society of the Plastics Industry, Inc. This represents a 20% increase over last year, and all indications are that it will be repeated in 1958.

Over 15 miles of vinyl-insulated wire have been incorporated into the circuitry of the newly-designed Convair 880 jet passenger liner. Material used is B. F. Goodrich's Geon 8800, which is claimed to have five times the insulation resistance of previously available insulators.

The entire polyester industry is imperiled by inadequate profit margins, according to W. E. Wirsch, manager of polyester sales for Rohm & Haas Co. He feels this to be due largely to the relatively limited number of applications for the available supply of materials. New markets must be found. (See guest editorial, page 991).

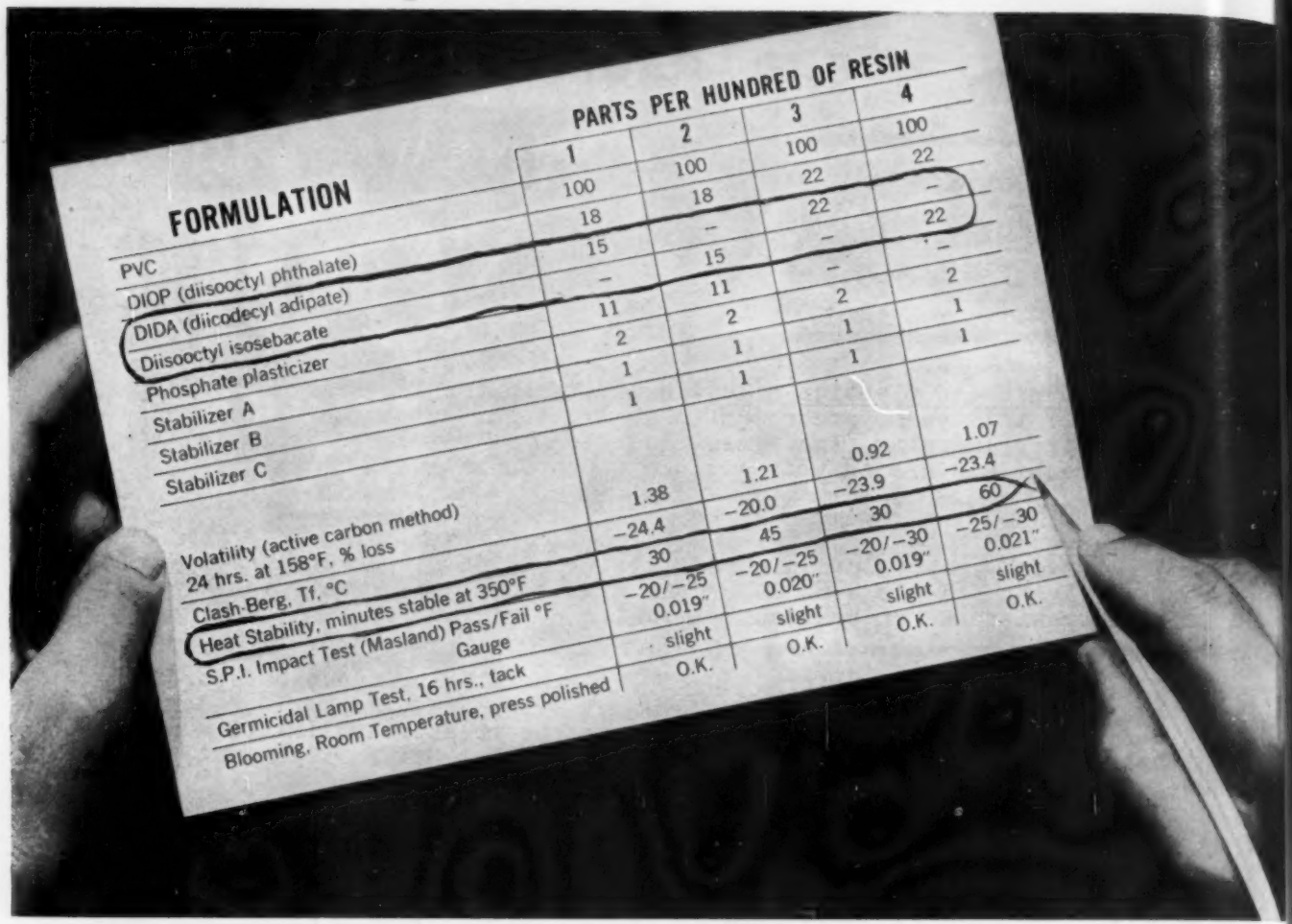
Company developments in the plastics industry find Minneapolis-Honeywell Regulator Co. coming out with a line of epoxy casting and potting compounds. The assets of Robbins Plastic Machinery Corp. have been purchased by Lynch Corp., makers of automatic packaging and conveying equipment. Chas. Pfizer & Co. has acquired Morton-Withers Chemical Co., which will be operated as an independent subsidiary. An expanded consulting service, Skeist & Schwartz Laboratories, Inc., is available due to their recent merger. Keno Plastics Processing, Inc., has been purchased by E Z Paintr Corp. Nylon production has been initiated by Spencer Chemical Co., under license by Onderzoekingsinstituut N. V., of Arnhem, Holland.

Company expansions were plentiful. Consolidated Molded Products Corp. opened a molding plant in Binghamton, N. Y. A $5.4-million expansion of its manufacturing facilities has been anounced by Foster Grant Co. Air Reduction Chemical Co. has boosted the capacity of it vinyl acetate monomer plant to 45-million pounds annually. Marbon Chemical Division, Borg-Warner, has opened a Cycolac processing facility. An over-all expansion program has been initiated by Plastics Fabricators, Inc. A $2-million phthalic anhydride plant in Azusa, Calif., has been placed on stream by Reichhold Chemicals, Inc. Du Pont has expanded its Belle Works. Allied's Semet-Solvay Petrochemicals Division has expanded its facilities for producing A-C Polyethylene. Plastics Materials, Inc., has opened a manufacturing facility in Chicago.

New Materials of note (see pages 1011-2): urethane cross-linking agent; melamine-bonded glass sheet; semi-rigid polyester resin; water-soluble polyethylene series; mastic for foams; Orlon and Dacron blankets; two resin vehicles; and a resin intermediate.

New Equipment of interest (see pages 1014 & 1016): abrasive tool line; roll-leaf stamping press; two hydraulic presses; vacuum metallizing unit; heavy-duty clamping tool; hydraulic actuation unit; and wire reels.

New Products showing ingenuity (see pages 1017-1019); nylon-coated runners; disposable vinyl cups; vinyl-coated place mats; reinforced plastic boat hull; reinforced plastic chalk board; acrylic hobbing material; acrylic faceted reflector; laminated diving boards; acrylic viewing unit; phenolic laminate spacer blocks; and Teflon clipper seals.


FORMULATION
PARTS PER HUNDRED OF RESIN
1 2 3 4
PVC 100 100 100 100
DIOP (diisooctyl phthalate) 18 18 22 22
DIDA (diicodecyl adipate) – – 22 –
Diisooctyl isosebacate 15 15 – 22
Phosphate plasticizer – 11 – –
Stabilizer A 11 2 2 2
Stabilizer B 2 1 1 1
Stabilizer C 1 1 1 1
Volatility (active carbon method) 24 hrs. at 158°F, % loss 1.38 1.21 0.92 1.07
Clash-Berg, Tf, °C –24.4 –20.0 –23.9 –23.4
Heat Stability, minutes stable at 350°F 30 45 30 60
S.P.I. Impact Test (Masland) Pass/Fail °F –20/–25 0.019" –20/–25 0.020" –20/–30 0.019" –25/–30 0.021"
Gauge slight slight slight slight
Germicidal Lamp Test, 16 hrs., tack O.K. O.K. O.K. O.K.
Blooming, Room Temperature, press polished

This test shows

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PHYSICAL PROPERTIES

Molecular weight	202.24
Combining weight	101.12
Density (80°C)	1.025 g/ml
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Melt viscosity (80°C)	78.5 centipoises
Specific heat of vapor (226°C)	0.34 cal/g (est.)
Heat of vaporization (226°C)	107 cal/g
Specific heat of solid (24°C)	0.33 cal/g
Heat of Combustion	1296 K cal/mole
Flash point (closed cup)	430°F.
Ionization constant at 25°C	$K_1 = 3.5 \times 10^{-5}$
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PLASTICS TECHNOLOGY

Design of Molds for Reinforced Plastics

A discussion of the constituents and components for proper design of steel molds from the mold maker's point of view.

JOHN C. REIB, *Vice President*
Shaw Industries, Inc., Franklin, Pa.

PRACTICALLY every manufacturer of reinforced plastics will agree that correct mold construction is necessary to the success of any molding job. He will agree that even with the most perfectly designed mold, the production of reinforced plastic parts at a profit is difficult and it virtually is impossible without the right tooling. This paper will present some suggestions for developing a degree of consistency in the design and construction of the right mold for the job at hand.

Since there are others more qualified in the field of development molds, short-run molds, aluminum molds, etc., and since our experience has been only with those jobs that warrant a very high production tool, this paper will deal only in positive pressure steel molds.

Space and time do not permit an adequate discussion of molds for premix materials since the requirements for these molds can vary from open flash-type temporary molds to hardened tool steel compression molds, depending on formulation of materials and the technique available. Premix molds often are designed exactly like those for high-pressure phenolic work with the same types of slide actions, ejector systems, etc.

John C. Reib was born in Cooperstown, Pa., in 1922. He took engineering courses at Pennsylvania State College, and also from International Correspondence School. From 1945-1954, he was employed by Shaw Industries, Inc., as moldmaker, leader, designer, shop foreman, and sales manager, in that order, before assuming his present position of vice president of the firm. In May 1956, he organized Rainco Mfg., Inc., as vice president. In addition, he is president of Reib Associates, a sales organization that handles all sales for Shaw, and local sales for The Rainville Co. He is a member of SPE and SPI. Mr. & Mrs. Reib have two children, and reside in Franklin, Pa.

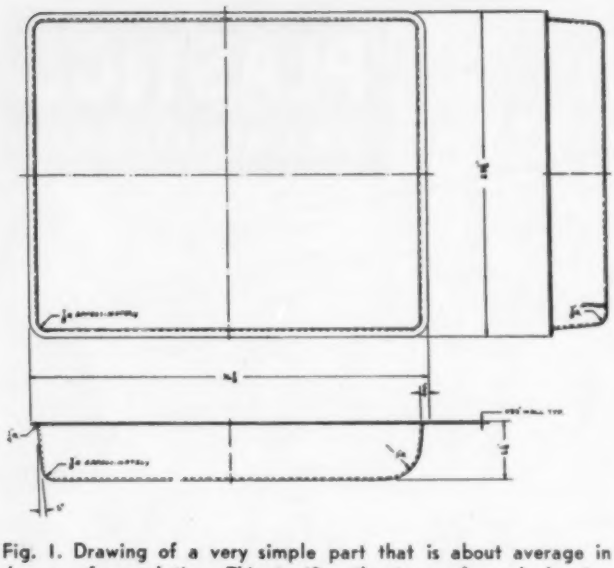

Fig. 1. Drawing of a very simple part that is about average in degree of completion. This typifies the type of usual drawing received by the mold maker.

In reinforced plastics, injection and compression tooling methods are an established and rather exact science. Even in this established industry, however, there is a basic inconsistency that may be expressed by this example. One would not send a form letter to a number of building contractors simply asking for a quotation for building an eight-room house, but giving no further details or information. How then can any degree of consistency in mold prices be expected if only a sketch of a part is submitted to several mold makers for quotation and they receive no description of the mold to be purchased? Yet, in the reinforced plastics industry, it has been a common practice to do exactly this and, also, to send that same incomplete sketch to the mold maker with an order for a mold. This approach usually produces a weird cross-section of estimates, and final results usually leave something to be desired.

Mold Design Steps

To design a good mold, one should start at the beginning by having the part drawing complete; that is, complete with all necessary dimensional data and providing all the latitude possible for the mold maker. You cannot specify a ±0.005-inch tolerance for wall thickness on a three-dimensional part for which the mold might weigh a ton or more. Temperature change alone may affect wall thickness on a large three-dimensional job, and close tolerances are expensive and time-consuming. For an illustrative example, let us design a simple imaginary part. Figure 1 is a very simple part drawing that is about average in degree of completion. These drawings often appear in photostat form that is not readable in at least one-quarter of the area and is reduced to no particular scale.

Now let us review the analysis that goes on in the mold maker's mind when he receives such a drawing and is estimating mold prices.

Mold Maker's Analysis

(1) MATERIAL.

SAE 1045 steel flame-hardened at shear edges. This choice is made because castings of any sort could create risk factors that would make it impossible to predict price and delivery. Castings possibly would provide a lower theoretical cost, but if you provide for plugging possible porous areas and steam leaks and time last for patterns and castings outside your own control, then you are gambling on both price and delivery. With a customer and a reputation at stake, let us not gamble; when it is steel, you are *sure*.

(2) METHOD OF CUTTING.

Kellering with a full model. Because the corner radii are pinned down as they are, a taper cutter for the side walls cannot be used for the corner radius. The blending of ¾- to ⅞- to three-inch radii calls for three-dimensional Kellering of the corners, so you might as well make a model and Keller the entire cavity.

(3) BENCHING.

This time becomes substantial because of the three-dimensional Kellering marks to be removed, and much time will be spent on the spotting press to acquire a ±0.005-inch tolerance on wall thickness.

(4) HEATING LINES

Not specified. We had better allow time for a uniform pattern of drilled steam lines in the cavity and milled channels in the back of the core to provide uniform heat.

(5) POLISHING.

Not specified. We should assume that a good finish is required, so plan on a uniform 400-grit finish that is rubbed out well to eliminate highlights and any scratches from prior grit sizes.

Now, let us assume the mold making procedures were carefully worked into the design of the part, and serious consideration given to leaving any open dimension to the discretion of the mold maker (see Figure 2). This would make possible an entirely different approach, as follows:

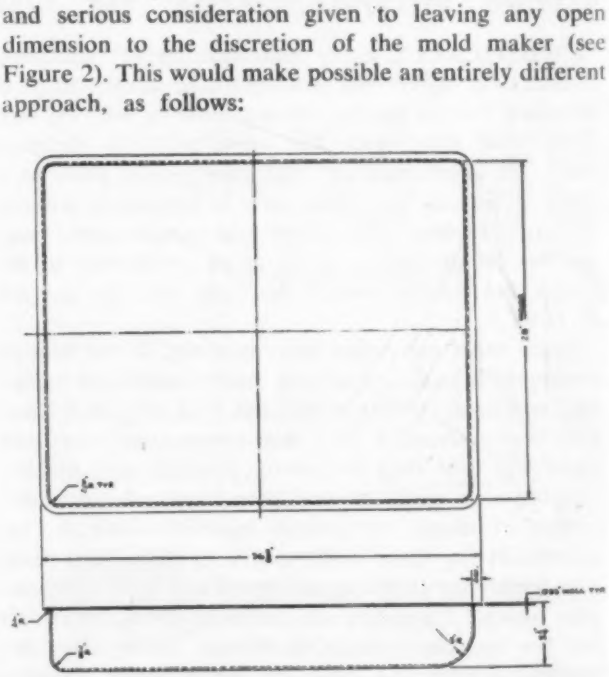

Fig. 2. Alternate part drawing showing design gives more necessary information to the mold maker than Fig. 1.

(1) MATERIAL.

The material still would remain the same.

(2) METHOD OF CUTTING.

Straight mill and/or profile (two-dimensional) Kellering can be used as a method of cutting, since the 5° taper cutter for the side walls can be 1¾-inch diameter at the mid-point. This can be used to cut the corner and bottom radii with a smooth blend to the side walls. The corner radius would be 1.114-inches at the top and 0.715-inch at the bottom, but still would be within tolerance. Three-inch radius can be developed by the two tracer template method with the same cutter. No model will be required.

(3) BENCHING.

Bench time has been cut as much as 50% because profiling is more accurate, and all but the three-inch radius at the end is smooth and well blended as it comes off the machine. There are no highlights to be removed. The open tolerances on the wall make it unnecessary to check it on the spotting press, since template checking will suffice.

(4) HEATING LINES.

The customer now has specified platen heating. (We have no comment on this score, except to say that we're confused by the fact that some molders can heat such molds from heated platens, while others require very uniform channeling).

(5) POLISHING.

Release polish only. Since this is a functional part, the bottom only need have the cutter marks removed, and the side walls draw polished. Polishing is much faster from a profile milled finish.

By a few simple changes in the part drawing, we have saved as much as 40% on the cost of this particular job. A more complicated example could have been chosen, and we could have written a book on possible savings in mold cost by the proper part design alone.

We recommend the use of mold data sheets with the original inquiry and providing all the latitude possible for the mold maker to develop efficient methods of machining. Drawings should be explicit and sharp, drawn to a definite scale, and not distorted as with most photostats. If the molder has preconceived ideas about any point of construction, he should make them known at the time of inquiry.

Importance of Models

Models are a very important point for consideration. On three-dimensional work requiring Kellering, it often is customary for the customer to furnish models. We recommend this procedure because the mold maker then has no problem of interpreting vague drawings, and can assume that the model is exactly what the customer requires. Trouble and expense occur, however, when: (1) the model does not conform to the drawing and must be corrected for dimensional accuracy; and (2) when the customer does not understand the details required by the mold maker. All those concerned should understand how complete such a model will be, and whether or not it will have shear edge and parting line established. This is most important on a three-dimensional job. The mold maker must beware of the customer who doesn't understand mold building procedures and who says that he will furnish a model complete, ready to mount on the Keller.

Designer's Needs

Now, let us proceed with a mold design for this job. Assume a mold is being designed according to the drawing shown in Figure 2, except that we will provide for steam heating. Before the designer can start, he must have the following information:

(1) Press platen layout, needed for size limitations of the mold.

(2) Method of clamping mold in the press.

(3) Which half of the mold will be "up" in the press. Unless we are told otherwise, we usually assume the core, or male half, will be clamped to the lower platen. This information is vital. The guide pins must be put in the bottom half of the mold to prevent resin running into the guide pin bushings, and steam system

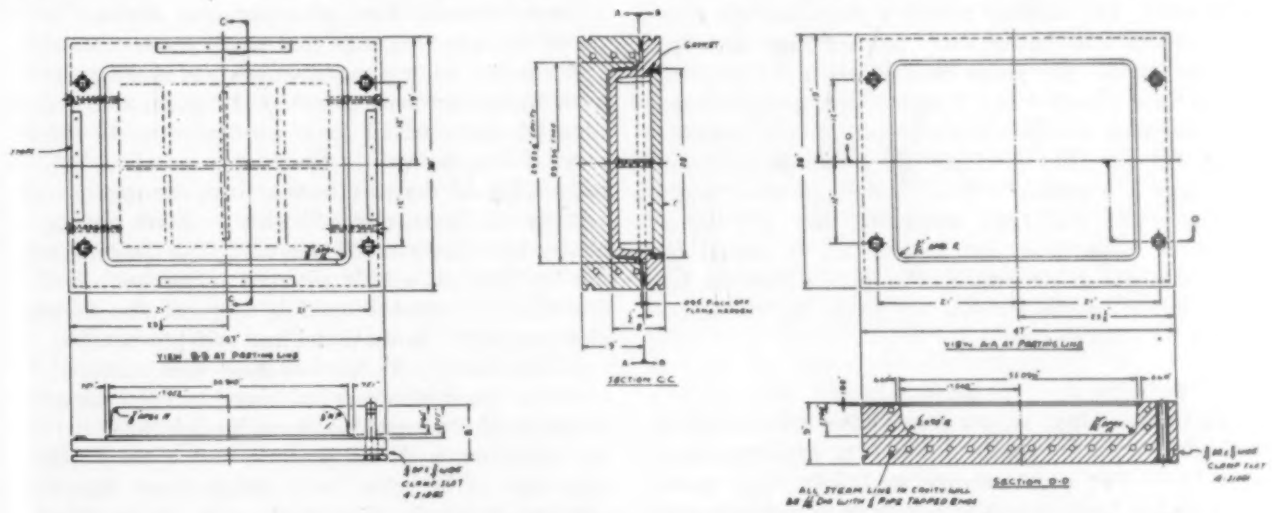

Fig. 3. Part design drawing is shown in simplified form (withoutdetailed dimensions) to demonstrate a principle of design.

must be designed to prevent condensate trap.

(4) Shrinkage factor, if any. This factor usually is 0.0005-0.001 inch per inch.

(5) Depth of shear edge. Unless otherwise specified, shear edges are telescoped from 1-1½ times the amount of material thickness, depending on the part shape.

(6) Any special features desired.

With this information, we proceed on the basis of presenting a drawing to the shop that is as simple as possible and uncluttered by superfluous detail, yet shows all necessary information. This drawing will be used by men who know their business and are familiar with the end-use of the mold they are building. With such training, it is necessary only to stress the unusual or critical points.

Mold Components

The design in Figure 3 is exaggerated, of course, in simplicity, and demonstrates a principle of design only, without need for detailed dimensions. Steel sizes are massive, not because of pressures involved, but in consideration of uniform distribution of heat from the drilled steam lines. If the steam lines were too close to the molding surfaces, hot spots would develop. To design this mold for uniform heating, we must channel the core by milling out the back. We then bolt and gasket a plate over this opening for sealing; ⅜-inch screws at four-inch spacing can be used if the plate is about one-inch thick. We recommend that these screws be tightened again after the mold has been heated and used for a short time in order to reset the gasket seal.

Guide pins need not be as large as one might suppose. Actually, the shear edge is one big guide pin, so these pins serve only to generally align the mold to start the two halves together, and act as an aid in construction. They probably flex a bit because of differences in expansions of the two masses of steel. This comment can be justified only by the fact that we have built hundreds of such molds that have been working a long time.

Shear edges never are designed with a radius or angle entry. This method probably motivated the original misnomer of "pinch off", because such a design did just "pinch" the glass. Even if well fitted originally, there are always a few filaments remaining between the telescoping members and a peening and/or abrasive action will take place, gradually worsening the condition until there is a serious amount of flash. If shear edges are sharp and well fitted originally, they will last a long time without serious loss of fit. It should be noted that the guide pins and stops are kept as far as possible from the molding surface to prevent interference by glass or resin.

Final Approval

The next step is to send a copy of this mold drawing to the customer for approval, and is a very important procedure. For more complicated jobs, we make quick outline lay-outs and submit them to the customer for comments. He is to return them well marked with his preferences, indicating that he, too, has given the matter serious consideration. Final design then is completed on that basis. We cannot overemphasize the importance of a "meeting of minds" in this matter of design. We further recommend meetings during the design and construction stages to make certain that all the problems encountered are solved to facilitate the techniques used by the particular molder.

Conclusions

The moral of the story is time. As a job becomes more complicated, much more time should be provided for all the elusive problems that develop during mold design and construction. If the mold maker were to assume too much to expedite delivery, the molder might find himself hampered throughout the entire production run by an inadequate tool.

As this paper chiefly concerns the design of molds, we shall not discuss the ramifications of actual mold construction methods. We would like to point out a few things that are expedited in the shop without benefit of drawing information. Since these men are artisans and take pride in their work, we try to keep them well-informed on customer requirements, reactions, and recent developments. For instance, we do not specify a clearance for the telescoping shear edge. These are fitted as closely as possible, preferably with no more than 0.002-inch of clearance. The molder then has some latitude that he may use to relieve and vent in strategic points to develop the desired flow of resin. This should take place by stoning or hand grinding the high spots after the mold has been brought up to heat. These will show up as shiny areas and can be removed easily from the male mold.

Holes for guide pins and bushings are bored "in assembly" after the two mold halves are fitted together. Guide pin bushings are checked and honed out for proper fit after pressing in place to correct any closing-in by the press fit.

All surface finishing and polishing is done with the thought of developing a release finish in all cases and the appearance finish required for the specific job. All vertical side walls are finish polished in the direction of draw. Heating systems are baffled and checked for unobstructed flow of steam and elimination of possible condensate traps that could create cold spots.

If the job is an irregular shape and defies measurement by conventional means, wall thickness and shear edge fits are checked in a spotting press. If the job is of fairly general shape, lead wire checking will suffice. Should the part be very irregular, plaster casts actually are "press-molded" with an exact amount of plaster by volume to fill the void. This "plaster part" can be lifted off a little piece at a time and checked thoroughly. Then, the mold is prepared for shipment after carefully coating it with a rust preventative.

In conclusion, if the customer has conveyed his needs to us, if the part drawing has been complete, if the mold designer has done his job well, if there are no errors in the shop work, and if the customer is certain as to what he is doing, there should be nothing further for him to do with the mold other than to await final approval. —THE E[ND]

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Hidden Injection Molding Costs

Cost factors include material loss from color and grade changes, contamination, hygroscopic properties, cylinder cleaning, and maintenance.

IN calculating selling prices for manufactured thermoset molded parts, the matter of raw material loss is recognized to be a significant factor. This loss is found as flash in compression moldings, and as culls on plunger molded parts. As a component of the total cost, the loss actually represents nothing more than the difference between the gross and net weights of the part being estimated. The amount of flash may vary anywhere from 5% on very large parts to as high as 25% on smaller ones. Regardless of the flash percentage, the overflow is scrap that is accepted as such, and written off accordingly on the estimate sheet.

The thermoplastics present a different problem entirely with regard to waste material. Instead of culls or flash, there are sprues and runners with which to contend. Theoretically, every ounce of material should be utilized in the injection molding process but, unfortunately, this condition does not hold true in actual practice. Despite all arguments advanced to the contrary, the realistic molder must take into consideration a certain loss of material when figuring his injection molded parts. Of course, this loss is arrived at in an entirely different manner than that used in figuring waste material loss on thermoset parts.

The most common method of calculating thermoplastic material costs is based on the premise that, inasmuch as no chemical change occurs during the molding operation, practically all of the material purchased is utilized in making the finished product. While this assumption perhaps is technically correct, actual experience will disclose the many unforseen factors that have been overlooked. In practice, therefore, it is impossible to use every ounce of all the various materials bought for injection molding.

In the molding of thermoplastics, the ratio of scrap to molded item generally is higher than that found in compression molding. This is caused by: (1) the necessary use of sprues and runners; and (2) the fact that comparatively smaller items usually are injection molded. Within the past few years, the latter consideration has been changing rapidly, and injection molded parts are being made larger and larger in size each year. However, where an average material loss of 10% may be allowed for flash or culls on a compression machine,

a figure of 25% really is low on very small injection molded parts. In many instances, the combined weight of sprue and runners may run as high as 50% of the total shot.

Change from one color to another cannot be accomplished without obtaining some cycles of pieces containing a mixture of the two colors. Color changes mean either the production of many mottled pieces or the making of many large lumps of mixed color material from open shots. Even when the specifications call for one color only in the molding of a particular order, a large percentage of the material has to be reground. This means the gradual thinning out of virgin material as it becomes mixed with second-and third-run compounds. Each time the material is run through the granulator, it becomes harder and tends to lose a certain amount of its original color.

When the transparents are specified, reground sprues and runners appear cloudy on the second run. If a high standard of product transparency is required, then the reground material is worthless. Consequently, there is a definite amount of material which never can be used in making the product for which it originally was purchased. The same condition holds true with regard to bubbles that appear in the production of transparent parts. Such rejects cannot be re-worked satisfactorily.

As a general rule, there are very few orders given for injection molded parts that specify one color only. Allowance, therefore, must be made for the change-over from a blue to a red, a green to a grey, or perhaps, from an opaque to a transparent. Aside from the thorough cleaning that must be given to the feed hopper, a large amount of material is wasted in the purging of the molding machine before a uniform color finally appears. If transparents are included in the order, the number of rejected parts is even more numerous than when changing from one opaque color to another.

In many cases, it is found necessary to run a certain item in two or more different thermoplastics such as acetate and polystyrene, for example. Whether there is a need for running different materials on the same item or on different items, additional purging must be performed. The incompatibilities of the thermoplastic materials makes such procedure necessary. This thorough cleaning of the machine produces pounds of material that have no value whatsoever. Every change of this nature represents a definite loss in production, as well as in material. Consequently, the procedure must be taken into account on the cost sheet. If the molder elects to change cylinders for each material, he can successfully circumvent his compound loss. However, he is faced alternately with the high labor cost of changing cylinders.

(Photo courtesy: Amos Molded Plastics, Inc.)

Fig. 1. Battery of injection molding machines with no provision for scrap regrinding.

So far, no mention has been made of the grinding operation. Regrinding sprues and runners actually is an indirect labor charge that directly affects raw material costs. In compression molding, an allowance is made for preforming. By the same token, the cost of the grinding operation has to be added to the price of thermoplastic compounds. Where a grinder is installed next to the press operator, the granulating operation can be performed during the molding cycle, but this arrangement is not always possible or practicable (see Figure 1).

It is common practice for molders to break off the sprues and runners from each shot while they are warm. These then are folded over and immediately thrown back into the lower feed chamber of the molding machine. This procedure would appear to be economical and, perhaps, it is from the standpoint of saving a subsequent grinding operation. However, the molding plunger is given an additional burden in pushing through large lumps of hardened material, and very often the saving realized may be more than offset by expensive maintenance repairs caused by breakage of interior parts in the molding machine. Furthermore, the amount of powder load has to be adjusted constantly to compensate for variations in weight charges entering the heating cylinder. As a result, many faulty molded parts often are made and entire shots sometimes are lost during the process.

Most granulating machines have limitations with regard to the cross-sections of thermoplastic parts they are capable of handling. The large annular deposits and open shots of material are bulky and possess very thick sections. These lumps very often are too large to be put through medium-sized granulating machines (see Figure 2). Furthermore, the grinder requires a very thorough cleaning each time a different color is run through it. This cleaning operation is not necessarily very expensive, yet the time spent has to be considered. Color changes on production runs definitely are reflected as either an added cost to the raw material, or an increased overhead figure. As can be seen, this applies to both direct and indirect labor.

Even though meticulous care is exercised in all the operations relating to injection molding, dust specks or oil spots are bound to get into the material to a limited extent. This contamination seldom can be avoided, and is especially prevalent when either transparents or lighter shades are being molded. Consequently, there will always be a certain percentage of finished product which neither can be used nor reground. While the loss thus caused is relatively small, it contributes to the general fund of hidden expenses. With some injection molding materials costing as much as $2.00 a pound, dirt-contaminated parts should be

given adequate consideration on the cost sheet.

The injection molder encounters his greatest difficulties during the summer months. Even in cold or dry weather, there are innumerable troubles to be overcome in order to maintain maximum molding efficiency. The humid months of July and August, however, play havoc with normal molding cycles because of the hygroscopic properties of most thermoplastic materials. In order to reduce this moisture absorption, it is necessary to utilize heating ovens. With the polyamides, moisture is such a problem that special dehumidifying equipment must be used, in addition to hopper-dryers. When drying procedures must be resorted to, the extra amount of labor involved must be either charged to the cost of raw material or added to overhead percentages.

Another hidden cost in injection molding that very often is not given due consideration is the time required to keep cylinders clean. More and more of the polyvinyls are being injection molded. These materials are comparatively unstable and tend to break down at normal molding temperatures. Consequently, injection machines that are operated on a 24-hour schedule on the vinyl copolymers require special attention. Interior walls of the heating cylinder must be given a manual cleaning very frequently. The nozzle, too, must be cleaned systematically when vinyls are being molded. This additional non-productive work is another instance of hidden expense which tends to increase the general overhead cost of operation. Needless to say, the brittle material formed by material breakdown is a total loss.

Maintenance costs, of course, are common to all manufacturing processes, and should not be included in a summation of hidden costs. Injection machines, however, require a substantial investment at the outset, and the repairs on these machines are quite expensive. From the mechanical construction of these presses, it is obvious that the interior components are under a constant strain during the rapid pace of molding cycles. Although repairs may be kept to a minimum by the exercise of care in operation, worn parts sooner or later require replacement. When these repairs are made, not only are the replacements expensive, but also a great deal of valuable production time is lost.

Conclusions

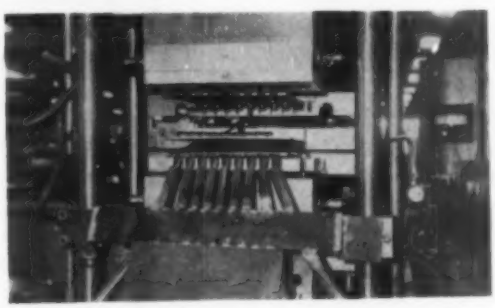
It can be seen that the computation of injection molding costs includes a wide diversity of obscure expenses. Unlike the thermosetting compounds, the acetates, styrenes, acrylics, and vinyls are reworkable. Therein lies one of the most important pitfalls in calculating injection molding costs. Because most of the thermoplastics are more expensive than the phenolics, errors in figuring raw material costs become further amplified.

It is impossible, of course, to define any hard-and-fast rule for the percentage of loss to be applied to the cost sheet. Certain mark-ups must be made if true costs are desired. Each molding plant uses different materials, has different types of equipment, and operates under its own particular conditions. In the final analysis, experience alone determines the true cost of producing the molded goods. On the basis of this experience, the injection molder will be able to better recognize hidden costs and prepare estimates that will coincide more closely with actual manufacturing costs.

—THE END

(Photo courtesy: Injection Molders Supply Co.)

Fig. 2. Wide throat grinder for large thermoplastic lumps.



Closeup of die table shows the runners and sprue about to be pushed off onto a slide which carries them to the scrap bin. Inserts are pushed into the nine tubes

Automatic Molding and Sorting

Installation of a Stokes Model 701 2-ounce injection machine at its Bristol, Va., plant has saved Monroe Calculating Machine Co. 85% in man-hours, and has boosted production of its numbered inserts for keyboard buttons by 13%. Operating virtually without attention, the Stokes unit automatically molds the nine different-numbered butyrate inserts.

Heaters are turned on by the plant guards before the arrival of the first work shift. The set-up man starts the machine, and checks periodically to see that the hopper contains adequate amounts of Tenite butyrate. Other than this, operation is completely automatic. The numbers, one through nine, are molded at one shot. On injection, the numbers are sorted, and the sprues and runners are channeled into a scrap bin.

—THE END

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Adhesive Bonding of Polyethylene

Chromic acid pretreatment of polyethylene surfaces

is shown to increase the strengths of adhesive bonds.

POLYETHYLENE exhibits many excellent characteristics which make it one of the most useful plastics for Army Ordnance Corps' applications. Mechanical toughness over the temperature range from —65 to +160° F., very low moisture-vapor transmission rate, total resistance to water, ease of molding, low density, low cost, excellent electrical properties, ease or heat sealing at low temperature, and good chemical and solvent resistance have been especially cited (1)*.

Occasions often arise whereby it becomes necessary to bond polyethylene, in the form of a film or a molded item, to itself or some other material such as plastic, metal, fabric, etc. In the form of a film, polyethylene can be heat-sealed satisfactorily to bond to itself or to some porous material such as fabric. If heat-sealing is not feasible, however, it may become necessary to fasten polyethylene by mechanical means or by adhesives. Since the low tensile strength and tendency to cold flow often make it impractical to fasten polyethylene by mechanical attachments, it may be necessary to fasten polyethylene in place by adhesives.

By using an adhesive to fasten polyethylene, a uniform stress distribution across the entire bonding surface can be attained. However, it is well known that high-strength bonding of polyethylene to any surface by means of an adhesive is most difficult, if not impossible. Most commercially available adhesives for bonding polyethylene are of the pressure-sensitive type. With these materials, bond strengths are of low magnitudes and are dependent for the most part on the permanent tack tendencies of the adhesive. Specific adhesion in polyethylene assemblies is inherently poor due to the nonpolar, paraffin-type molecular structure of this material.

A plastic material containing one or more polar groups such as (—OH), (—COOR), and (—CN) usually can be bonded with at least a few of the many commercially available polar adhesives to provide bond strengths which often are equal or higher than the mechanical strength of the plastic itself. In order to obtain high-strength adhesive bonding to polyethylene, therefore, it becomes necessary to pretreat the plastic to effect changes that will improve specific adhesion to its surface.

Various treatments of polyethylene to improve adhesive bonding properties have been described in patents, including an instantaneous chemical treatment with chromic acid (2); treatment of polyethylene surfaces by subjection to a hot blast of air (3); flame-contact treatment of polyethylene surfaces (4); and electron bombardment of the polyethylene surface (5). All of these methods are intended to alter the polyethylene surface, thereby improving its adhesive characteristics.

Electrical methods involving high voltage (6) also have been utilized for this purpose. In one method

*Numbers in parentheses refer to bibliography at end of article.

a blue glow discharge completely envelopes the polyethylene film contained in a glass bell jar which is being evacuated. The other method consists of passing a brush discharge from the high-voltage side of a Tesla spark coil over the polyethylene film. From infra-red spectra analysis, treated films were found to contain both unsaturated (C=C) and carbonyl (C=O) bonds in the molecular chains with improved bonding properties probably due to oxidation.

The present work was undertaken to determine quantitatively (by measuring bond strengths) what effects chromic acid treatment of polyethylene has on adhesion of bonded polyethylene assemblies undergoing both shearing and peeling stresses. The chromic acid process was selected for study because it was considered to be the most practical and feasible for most Ordnance Corps applications involving the bonding of polyethylene. Effects of variations in time and temperature of the acid treatment on adhesive strength were studied in this work. Also the effect of the acid treatment on the strength of polyethylene was determined.

Test Procedure

Acid pretreatments of all polyethylene parts consisted of immersion in a solution of the following compositions in parts by weight:

75 potassium dichromate
120 distilled water
1,500 conc. sulfuric acid (sp.gr., 1.84)

The solution was maintained at the desired temperature and the parts kept immersed for measured time periods. All parts were rinsed under large volumes of cold running tap water immediately upon removal from the solution, then air-dried at room temperature.

Peel-strength specimens were prepared by bonding strips of chromic acid-treated polyethylene, one by 12 by 0.020-inches in size, to steel panels that measured one by eight by 1/16-inches. The adhesive used was Pliobond**, a phenolic-modified nitrile rubber-type solvent adhesive. Treatment times of the polyethylene were five seconds, one minute, five minutes, 15 minutes, one hour, four hours, and 24 hours. After application and curing of the adhesive, the peel strengths were determined on a universal testing machine at 73° F. and 50% relative humidity. Ten specimens were prepared and tested for each acid exposure period. The tests were conducted at a peeling separation rate of six inches per minute and a peeling separation angle of 180°, according to Test Method 1041 of Federal Specification MMM-A-175. Average peel strength values versus time of acid treatment are plotted in Figure 1.

Shear-strength specimens were prepared by bonding strips of chromic acid-treated polyethylene, one by four by 1/8-inch in size, to steel panels of the same dimensions to give an overlapped bonded area of one by 1/2-inch. The adhesive used was Cycleweld C14#, a modified epoxy. Sets of specimens were included, representing variations in pretreatment time of the polyethylene strips in concentrated chromic acid at both room temperature and 160° F. Times of immersion in acid at room temperature were instantaneous (less than two seconds), five seconds, one minute, five minutes, 15 minutes, one hour, four hours, and 24 hours. Times of immersion in acid at 160 F. were instantaneous (less than two seconds), five seconds, 20 seconds, one minute, two minutes, five minutes and 10 minutes.

After application and curing of the adhesive, the bonded shear specimens were tested destructively in a universal testing machine at 73° F. and 50% relative humidity. Ten specimens were prepared and tested for each acid exposure time-temperature variation. The shear tests were conducted at a constant rate of loading of 600-700 psi. per minute, according to Test Method 1033 of Federal Specification MMM-A-175. Average shear strength values versus time of acid treatment are plotted in Figure 2.

Tests were conducted to determine the effect of acid treatment on the tensile strength of polyethylene strips one by 12 by 0.020-inches in size. Seven untreated strips and seven strips pretreated in concentrated chromic acid for 24 hours at room temperature were pulled in tension in a universal testing machine. The recorded load-deformation curve of each strip was analyzed. Loads required to produce yield strength failure (when the specimen began to stretch excessively) and rupturing (ultimate strength) were noted. The average tensile curves for the treated and untreated strips are shown in Figure 3.

Test Results

The most significant changes in polyethylene that were observed visually immediately after acid treatment were some discoloration (yellowing), and the ability of the surface to be "wet" by water. Untreated polyethylene surfaces exposed to water do not "wet", the water immediately forms into large droplets instead of spreading out across the surface as a thin film.

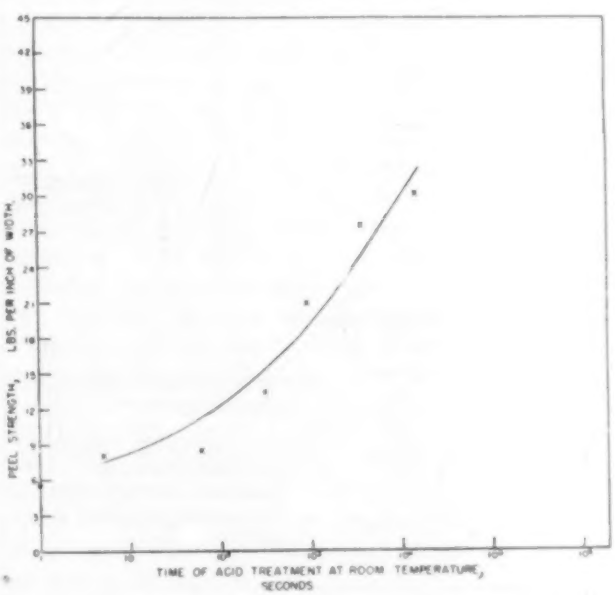


Fig. 1. Effect of duration of acid treatment on the peel strength of the bond when polyethylene is bonded to steel by means of Pliobond adhesive.

**Products of Goodyear Tire & Rubber Co., Akron, O.
#Product of Chrysler Corp., Detroit, Mich.

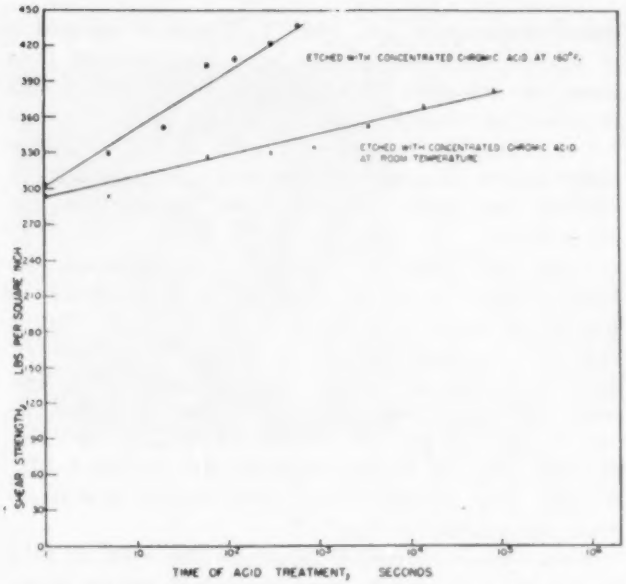

ETCHED WITH CONCENTRATED CHROMIC ACID AT 160°F.
ETCHED WITH CONCENTRATED CHROMIC ACID AT ROOM TEMPERATURE
SHEAR STRENGTH, LBS PER SQUARE INCH
TIME OF ACID TREATMENT, SECONDS

Fig. 2. Effect of duration of acid treatment on the shear strength of the bond when polyethylene is bonded to steel by means of Cycleweld C-14 adhesive.

This condition of non-wetting is due to the high surface tension of water and the non-polar chemical structure of untreated polyethylene.

A prime requisite for strong and reliable bonding is that the adhesive wet the surface of the solid adherent to which it is applied. If water spreads onto (or "wets") a surface, it is a reasonable certainty that an adhesive will do likewise, since the free surface energies of most common plastic surfaces (including adhesives) are less than those of water[3].

When exposed to concentrated chromic acid at room temperature for only a few seconds or longer, the non-polar surface of the polyethylene is oxidized and good wetting is obtained. Acid exposure for periods in excess of one hour at room temperature or two minutes at 160° F. results in yellowing of the polyethylene surface. The severity of this condition increases directly with the length in time of the exposure period, especially at elevated temperatures.

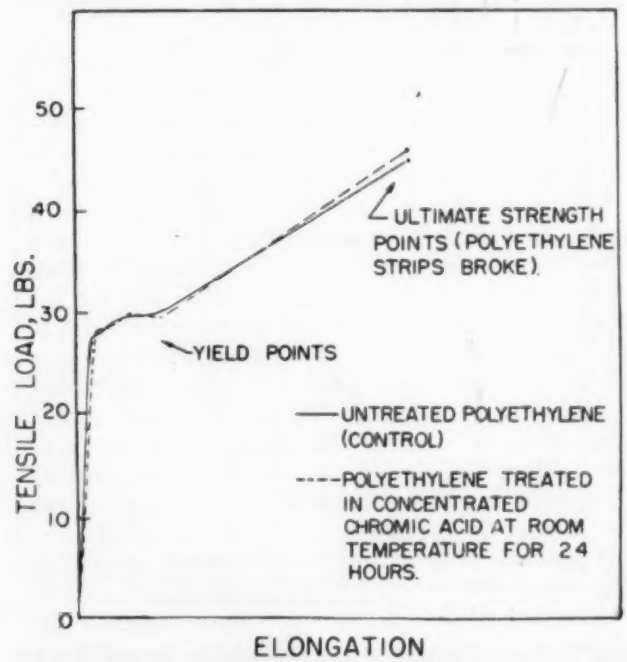

TENSILE LOAD, LBS.
ELONGATION
ULTIMATE STRENGTH POINTS (POLYETHYLENE STRIPS BROKE).
YIELD POINTS
——UNTREATED POLYETHYLENE (CONTROL)
----POLYETHYLENE TREATED IN CONCENTRATED CHROMIC ACID AT ROOM TEMPERATURE FOR 24 HOURS.

Fig. 3. Effect of concentrated chromic acid treatment on the tensile strengths of polyethylene test strips.

The selection of Pliobond for studying peel strength adhesion was based on a preliminary comparison of various adhesives. Polyester, polysulfide, epoxy, and polysulfide-modified epoxy-type adhesives were found to give less consistent peel-strength results.

As shown in Figure 1, an average peel strength of eight pounds per inch after an acid exposure period of only five seconds at room temperature was obtained with Pliobond. As exposure times were increased, considerable direct increases in peel strengths were exhibited. Treatment time in excess of one hour at room temperature resulted in average peel strengths of more than 27 pounds per inch, with elongation and rupturing of the polyethylene adherends occuring during testing.

The selection of Cycleweld C-14 for studying shear strength adhesion was based on preliminary shear strength tests comparing various adhesives for bonding acid-treated polyethylene. Although good shear strength bonds were obtained with both resorcinol-formaldehyde resin and polyester resin adhesives, Cycleweld C-14 gave the highest and most consistent results.

As shown in Figure 2, average shear strengths ranging from 294-253 psi. were obtained for acid-exposure periods ranging from less than two seconds to 24 hours at room temperature. Acid exposure at 160° F. for periods ranging from less than two seconds to 10 minutes resulted in average shear strengths ranging from 303-437 psi., with some elongation and a few instances of rupturing of the polyethylene adherends occurring at the higher values.

Results indicate that peeling stresses are more sensitive to shearing stresses than to time variations in the acid treatment of polyethylene. Accordingly, the utilization of longer acid-exposure treatments was more effective for further increases in peel strength adhesion than for shear strength adhesion. Relatively short acid-exposure treatments were very effective in yielding shear strength adhesion values which were close to the maximum obtainable. These findings are most apparent when Figures 1 and 2 are compared.

As shown in Figure 3, no significant differences in the tensile strengths of untreated and acid-treated polyethylene strips were found. These results substantiate a hypothesis that the acid treatment conducted in this test probably affected, through chemical reaction, only the molecular layers on or adjacent to the surface of the exposed polyethylene strips, with little or no change occurring throughout the underlying layers.

Undoubtedly, it would be of interest to conduct further investigations in order to determine the effects of the acid treatment on other properties of polyethylene, such as electrical and aging characteristics. Also of interest is the applicability of the acid treatment to improve the bonding properties of the newer, "high-modulus," rigid-type ethylene polymers of more linear, crystalline molecular structure. Preliminary specimens consisting of acid-treated Grex Polyolefin Resin## bonded to steel have been prepared and

##Trademark of W. R. Grace & Co., Polymer Chemicals Div., Clifton, N.J.

(Continued on page 996)

WILLIAM E. WIRSCH, *Mgr. of Polyester Sales, Rohm & Haas Co., Philadelphia, Pa.*

Better Performance—

The Way Out Of The Polyester Squeeze

THE entire polyester industry — distributors, processors, and resin producers alike—is being pushed by inadequate profit margins to the point of no return on its investment in equipment, people, and service. This development is a result of the relatively limited volume of applications for the available supply of materials. The intense price competition which prevails throughout the industry is not to any significant extent based on production economies, but reflects the imbalance between supply and demand. Production economies are desirable, of course, and should continue to be made so long as they do not lower product quality nor increase the downward pressure on prices at the very time when exactly the opposite trend is urgently needed.

As a resin producer, we are convinced that the solution to the problems that afflict the industry lies in attracting new business by making polyesters a better material for a wider variety of applications. Expanded markets and new applications are going to depend on upgrading performance. A great deal must be done to increase fire resistance, develop better curing methods, and improve stamina under a greater range of environmental conditions.

Since one of the major uses for polyesters is in glazing and exterior building panels, we have felt that the most immediate problem is to improve outdoor properties. Better weathering characteristics are needed not only to prevent a dangerous loss of confidence among present users and specifiers, but also to stimulate the additional outdoor applications that probably will represent a significant market for some time to come. To that end, we have directed substantial effort to developing an acrylic-modified polyester, which we feel markedly upgrades the outdoor performance of the material. We have accumulated more thar two years of Florida exposure test data comparing acrylic-polyester panels with panels made with conventional light-stabilized polyester resins. Similar tests have been running for more than three years at our plant in Bristol Pa.

These exposure tests, which are continuing, demonstrate that the modified resin goes far toward overcoming the limitations of polyesters in outdoor service. The acrylic-modified specimens, which had superior gloss initially, retained 87% of their gloss after two years, while the specimens made from conventional resins retained less than 5% of their gloss. Color stability, as measured by percent of color change, was 2.5-3 times better for the modified than for the standard resins. Similarly, the acrylic-modified panels were practically free of crazing, erosion, and fiber blooming.

Certainly, the polyester picture is far too complex to be changed by any single development of this nature. But unless progressive steps are taken in this direction, the industry is likely to remain frozen in its tracks, competing for a static volume of business. We believe that poly-esters can earn a future for themselves by doing a better job in present applications, and by becoming adaptable to a wider range of service capabilities and requirements.

—THE END

R. J. DELLA ROCCA, *Asst. Engineer, Design Development, Gibbs & Cox, Inc., New York, N. Y.*

Reinforced Plastics in Boat Hull Construction—Part II

The conclusion of a two-part article in which glass-reinforced polyesters are shown to meet the design and strength requirements for successful boat construction.

Design Criteria

Due to the violent action of the sea during storm conditions, boat hulls may be subjected to various types of forces. These forces, in addition to impact, may create different types of stresses such as tension, compression, flexure, sheer, torsion, or any combination of these stresses. The resultant stress may be of any magnitude or direction. It is obvious, therefore, that determining the stresses in a boat hull under storm loading conditions generally is an extremely involved problem. To determine the necessary scantlings of a boat hull, it becomes necessary to assume possible maximum loading conditions based on experience and judgement. For small boat hulls under 35 feet in length, design loadings usually are not considered and scantlings are based on intended service and past performance of similar hulls. For larger hulls, deck and shell loading may be assumed, depending on intended service. In addition, experience and past performances of certain types of materials and hull construction are used as guides and for comparison.

In general, the allowable stresses for boats of wood construction are based on a factor of safety of 6 for the ultimate tensile and flexural strengths, (10, 11, 12), and do not include any reduction for decay. For welded steel construction, the factor of safety varies from about 2.5-5, and for welded aluminum construction, from about 3-5 of the ultimate tensile strength. These factors of safety are dependent on the size of the boat, the expected service, and vary with assumed loading, vibration, fatigue, corrosion, and high-stress concentrations.

For most FRP boat hulls, a factor of safety of 4 on the safe ultimate wet strength is considered adequate. For high speed planing hulls, a factor of safety of 5 is suggested. In general, these factors should provide sufficient safety for normal impact, fatigue, and reduction of strength under constant long-time loading. For specific areas of possible known repeated impacts, reversal of stresses, and long-time loading, factors of safety should be increased accordingly.

Strength analysis of laminates will vary with reinforcement. Generally, mat-reinforced laminates are considered to be isotropic (equal strength and elastic properties in every direction) and can be analyzed with the same elastic theories (13) as used for metals. Cloth and woven roving laminates are considered or-

thotropic (different strength and elastic properties in different directions), and the method of analysis will depend on the direction of load in relation to the glass fibers. For laminates with a single type of reinforcement, and for loading parallel to the direction of the glass fibers, the method of analysis will be similar to the method used for mat laminates.

For composite laminates with two or more types of reinforcement, and for loading parallel to the direction of the glass fibers, the same type of analysis is used as for any other composite section where the moduli are considered is applicable. For cloth laminates with a single type or more reinforcement, and for loading at an angle to the direction of the glass fibers, the method of analysis (3,8) becomes complex and requires the assumption that the strength properties and elastic constants of the laminates are proportional to the amount of glass fibers parallel to the direction of stress. The method of analysis for rib and plate construction is the same as for composite laminates with loading in the direction of the glass fibers. In the development of ribs molded or bonded to the skin laminate, care must be taken to be sure that the horizontal shear stress at the plane between the ribs and plate does not exceed the laminate's interlaminate or bond stress.

Variation of FRP laminate thickness has a decided effect on physical properties. Laminate thicknesses less than ⅛-inch have substantial reductions in tensile, compressive, and flexural properties; laminates approximately ⅛-inch in thickness appear to have optimum strength properties; and laminates above ⅛-inch thickness tend to decrease in flexural strength with increasing thickness. The reasons for this variation in strength properties have not been established, but are believed to be related to uneven conditions of cure and shrinkages. Physical properties data presented in Tables 1 and 2 are representative of laminate thicknesses and densities to be expected in boat hull construction with a minimum of ⅛-inch and a maximum of ½-inch in thickness.

Strength analysis of sandwich construction for loading in the direction of the fibers may be considered simply as a structural I-beam section where the outer facings (similar to the beam flanges) resist all bending stresses, and the core (similar to the beam web) resists all shear stresses. The core also must provide sufficient support to prevent the facings from buckling. In a well-balanced design, the facings, core, and bond between facings and core must have sufficient strength to equally resist the applied load. A more rigorous analysis of sandwich construction (14,15), if warranted, will result in greater accuracy in determining the facings and core materials and thicknesses.

FRP Boat Hull Construction

FRP boat hulls may be constructed of single-skin laminates, single-skin laminates stiffened with ribs or frames, sandwich construction of thin face laminates with a low-density core, or some combination of these types. Selection of the type of construction is dependent upon the hull size, appearance, intended service, reinforcement, fabricator experience, quantity, and economical production. Considerable controversy exists presently as to the most suitable type of construction for any specific FRP boat hull, since extended service experience is lacking, particularly for larger boats above 24 feet in length.

Usually, more than one type of construction may be suitable, but only one specific type will result in the most economical design. In general, most fabricators developing a new small boat for quantity production will produce a prototype for testing to ascertain soundness of the hull structure, performance of the hull form, and suitability to mass-production. Modifications to improve the original prototype usually are necessary prior to quantity production, and may continue to further improve the hull and reduce production costs. This usually is impractical for larger boat hulls unless quantity production is contemplated.

The majority of FRP boat hulls in quantity production are 16 feet or less in length, and are mainly for power-driven boats. These boats normally are of single-skin laminate construction with a minimum of longitudinal stringers to provide stiffness to the sides and bottom of the hull, and to prevent panting or dishing of the thin hull skin. Some boats have considerable curvature in the hull sides, while others have hard chines to provide inherent hull stiffness and minimize internal stiffening. Thwarts (seats) and single-skin decks, framed when necessary, provide transverse stiffness to the hull sides and prevent the gunwhales from bowing in or out. Sailboats, both new and of older classes, also are being produced of FRP in moderate quantities, with one specific new class of boat hulls numbering about 700 after these years of production. FRP sailboats up to 30 feet in length, like the powerboats, usually are constructed of single-skin laminates with transverse ribs or longitudinal stringers for stiffening, when required.

Skin thicknesses of single FRP laminates for boat hulls vary from a minimum of ⅛-¼ inches at the sides to a maximum of 3/16-⅝ inches at the bottom, depending on hull size, shape, and rigidity. Stiffening transverse ribs or longitudinal stringers normally are of the closed or hat section type, and are molded integrally over a low-density core either with or after the hull skin has cured. Double skins with a core also are used in some powerboats at the transom (back end) to accommodate the heavy outboard motors. Non-load carrying cores for the stringers, ribs and transom, generally are of balsa wood, waterproof plywood, or low-density expanded unicellular foam. Cores of hollow rectangular aluminum tubing cut to fit the hull form, half-round paper tubing, and waterproof paper honeycomb are also being used in some FRP boat hulls. A considerable number of FRP boat hulls of single-skin or single skin-and-frame types of construction, 24 feet or less in length, are being mass-produced successfully primarily for the pleasure boat market. Military craft, specifically the Navy's 12-foot Wherry and 26-foot Motor Whaleboat, also are being made economically if single-skin construction.

Composite types of hull construction with FRP laminate skins and wood, steel, or aluminum load-carrying framing have been used primarily for both small and large prototype hulls. In general, most of the hulls where these rigid cores were encased completely in

the laminate have been unsatisfactory. Experience has proved that solid wood cores have a tendency to swell and crack the laminates covering them, causing additional water penetration for increased deterioration. Certain aluminum alloys and mild steel, when completely encased in the laminate, will corrode and rust, breaking the existing poor bond between the laminate and metal and causing failure of the laminate under load. In addition, the large difference in moduli of FRP laminates and metals creates unequal stress distribution in these composite sections, causing high stress concentration in the laminate-to-core bond and probable failure.

FRP laminate skins also have a tendency to shear at the edge of a rigid wood or metal frame when subjected to impact loads near the frame. The structural performances of composite boat hulls of FRP laminate skins and rigid wood or metal load-carrying frames are exceptionally difficult to predict. FRP boat hulls of this type of construction may result in excessive damage and repair, and should be avoided whenever possible. Stiffening cores should be considered as a form to laminate over, and not as contributing to the flexural strength of the section and hull. This results in an all-FRP hull with approximately equal moduli throughout, assuring greater unison in rigidity and in resisting applied load.

Intermediate decks and interior bulkheads, when required in larger FRP hulls, are of stiffened plywood, stiffened single-skin FRP laminates, or of sandwich construction with FRP laminate facings. Generally due to cost considerations, stiffened plywood often has been selected. Decks and bulkheads of stiffened single-skin FRP laminates and sandwich construction have been used in very few boat hulls. In a number of FRP boat hulls, complete single-skin FRP moldings of the interior accommodations, including seats, deck, partial bulkheads, etc., have been used successfully for economical production. Intermediate decks and bulkheads of sandwich construction with FRP facings and low-density core are recommended for maximum rigidity with minimum weight.

To eliminate hard spots in single-skin FRP hull laminates at intermediate decks and interior bulkheads, flexibility can be provided at the connections. For intermediate decks, it is suggested that a FRP angle or tee-section be molded to the hull side to which the deck is connected by bonding and metal fastening. For the bulkheads, continuous triangular corner fillets of rigid unicellular foam are recommended prior to placing the wet lay-ups for the connecting angles. This will allow slight yielding and gradual transfer of load which is very effective for resisting impact loading.

Other hull connections usually are made with bolts or self-tapping screws when permanency is not required. For permanent connections, the joint is bonded with an adhesive in addition to being bolted or screwed. The strength of bonded joints without bolts or screws varies considerably, depending on the adhesive, type of cure, preparation of bonding surfaces, and workmanship. Normally if the bond is satisfactory, an ultimate shear strength of approximately 1,500-2,000 psi. (16) can be obtained. Bonded joints without bolts or screws may be used to resist direct shear and compression, but bolts or screws are necessary when the joint is subjected to tension pulling normal to the bonded surfaces. Connections through the hull below the waterline are not recommended, and should be avoided wherever possible.

FRP boat hulls constructed of single-skin or single skin-and-frames require the addition of air tanks or positive buoyancy material to provide flotation when damaged. Usually, unicellular fire-retardant Styrofoam weighing approximately 2.0 pounds per cubic foot and providing approximately 55 pounds per cubic foot of reserve buoyancy is added under the seats and deck.

The application of FRP laminates for boat hulls of single-skin or single skin-and-frames construction 30 feet or longer in length has been relatively limited when compared to smaller boat hulls. These boats include 30-42 foot sailboats, 53- and 54-foot cabin cruisers built in England (17), 40-foot Coast Guard utility boats (18), and a few landing craft prototypes. The FRP laminate skins are strengthened with mat, cloth, or woven roving reinforcement, and vary in thickness from ¼-¾ inches. The cores for the stiffening frames are of wood, aluminum angles, aluminum tubing, or cellular acetate foam. Most of the hulls were fabricated by the contact molding method in female molds.

The hull skin laminate for the 42-foot sailing ketch was molded over a wood shell of laminated mahogany veneer strips approximately ½-inch thick which remained as the inner part of the hull skin (19).

Although these boats vary in types of reinforcement and framing, completed tests and actual performance data on all boats, except the 42-foot ketch, resulted in minor damages to only the 40-foot Coast Guard utility boat. These damages consisted of cracks in the secondary bond, at fastenings, and in the engine housing, cabin overhead and pilot house laminates. Since these boats are relatively new, long-time service experience still is non-existent for the proper evaluation of larger FRP boat hulls.

Of considerable interest in FRP laminate application to boat hulls is the development for production of a 24-foot lifeboat (20) which has passed the tests required by the British Ministry of Transportation. This boat is built of mat laminate, and is constructed by placing an inner shell molding of the entire interior into the outer shell molding prior to curing of either shell. As curing takes place, the inner and outer shells become a single structure, and the inner shell forms the tanks, sidesheets, thwarts, and outer shell stiffening. This application of FRP laminates to boat hulls is of great importance, since lifeboats are of primary necessity to the marine industry.

Sandwich construction for FRP boat hulls has been limited primarily to larger military craft for testing and evaluation. Types of sandwich construction being considered are of FRP cloth or woven roving laminate facings with resin-impregnated, waterproof, paper honeycomb, cotton duck honeycomb, or unicellular foam resin cores. Sandwich construction provides inherent hull rigidity without transverse or longitudinal stiffening. It also provides sufficient reserve buoyancy in the core between the skins, and will retain watertight integrity of the hull if only the outer skin is damaged.

This type of construction is intended to reduce production costs by the elimination of an expensive mold and by building the complete core over a lightweight wood frame prior to laminating the facings on the core. It is intended also for reduction in weight by reducing the total laminate thickness when inserting the core between the facings and obtaining equal or greater flexural strength and rigidity.

Sandwich construction with waterproof paper or cotton duck honeycomb cores is attractive because of its apparent simplicity, but has disadvantages that should be considered when applied to boat hulls. Unless sufficient pressure is applied when placing the first layer of reinforcement onto the honeycomb core, it is difficult to assure complete bonding between the facings and core. Possible water leakage may occur and travel along this bond line undetected. Repairs to the honeycomb core sandwich are more difficult and costly. Production costs may be greater for quantity production since considerable labor is required to build the entire honeycomb core for each craft prior to laminating the facings on, and to turn the hull over after one facing has been applied. Greater total laminate thickness probably will be required for equal impact resistance, since the sandwich hull has less resistance to impact than single-skin hulls.

Sandwich construction with cotton duck honeycomb core was used for a 50-foot sectional, self-propelled barge for the Army Transportation Corps (21) and a 57-foot minesweeper for the U. S. Navy (16). Until specific performance data becomes available, this type of sandwich construction cannot be fully evaluated. Sandwich construction with paper honeycomb core was used for 36-foot landing craft prototypes (16), the second prototype of which is being service tested currently.

Sandwich construction with unicellular foam cores appears to have tremendous possibilities. Present foam cores consist of built-up pre-foamed polystyrene (Styrofoam) slabs, pre-foamed cellular cellulose acetate (Strux) boards, and foamed-in-place polyester resin. A 36-foot landing craft with a built-up Styrofoam core has been built and is undergoing tests presently. Again, labor costs to shape and to build-up the pre-foamed cores appear to be excessive. On the other hand, if the cost of the foamed-in-place resin core can be reduced substantially, this type of sandwich construction may be widely accepted for FRP boat application. A feasibility study of 36-foot landing craft (22) concluded that this type of construction, when properly developed, would be the most desirable because of its simplicity of design, fewer parts, suitability to mass production, and expected serviceability.

Future Expansion

The continued successful growth of the FRP boat industry is dependent on its ability to develop and build safe economical designs of larger FRP boats. In this respect, the increasing potential market for FRP boats 24-50 feet in length requires immediate consideration. Complete knowledge of the characteristics and properties of this material must be obtained, based on experience and required testing. The assemblage of necessary data can only be accomplished by mutual participation of all companies concerned with the future growth of the FRP boat industry.

Of prime importance is the need for standardization, not only of basic materials and molding techniques, but also of the finished FRP laminates. Standardization of presently-produced laminates is required to establish reliable data. This also can be the basis for future improvements of materials and new types of FRP laminates, and provide an incentive for improving the quality of finished boat hulls. Of equal importance is the need to establish a manual of design criteria and strength data for use by designers in the development of new types of boat hulls for greater efficiency in performance and economical quantity production.

Performance data on the different types of hull forms and constructions should be established, based on previously proved designs. This information should contain data on effects of environment, temperature, stress concentrations, and other factors that may effect the strengh of the finished hulls. This type of data can be developed only from experience, and can be extended eventually to the development of FRP boat design rules similar to those established for wood and steel hulls by Nevins and Herreschoff.

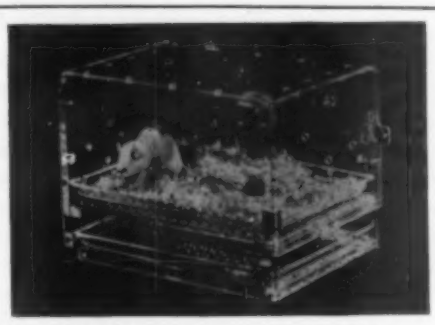
Of considerable importance to the entire FRP industry is the recent announcement (23) of a program established by Owens-Corning Fiberglas Corp. to plan and implement projects that will provide necessary engineering data for the design of reinforced plastics. This program includes the development of a design manual for the marine field that is of particular importance to the FRP boat industry. This program also provides a great opportunity for the establishment of standardization, so badly needed by the FRP boat industry. The response of the FRP industry to this program to date has been most gratifying.

Acknowledgments

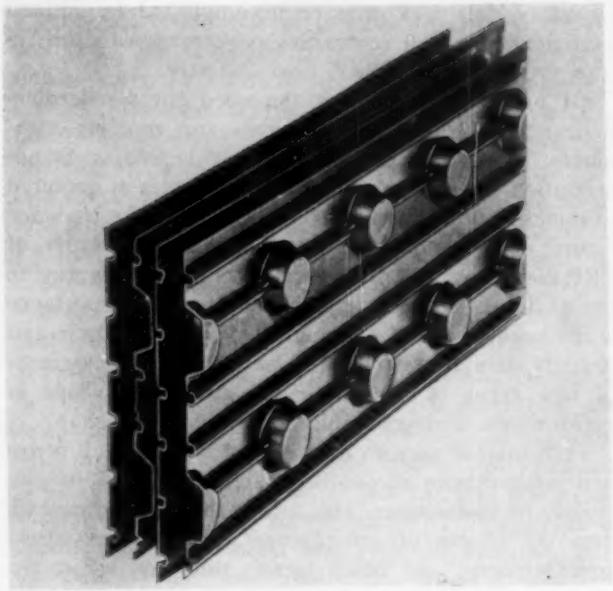
The author is very grateful and deeply appreciative to all of the companies and governmental agencies for the information and data they provided to make this paper possible. Without their cooperation, the scope of this paper would have been drastically curtailed.

The author wishes to thank the following Gibbs & Cox, Inc., personnel: J. D. Leigh, for the development of the tables presented in this paper; T. M. Buermann, for his excellent suggestions and final review of this paper; and M. G. Forrest, for his encouragement to write this paper.

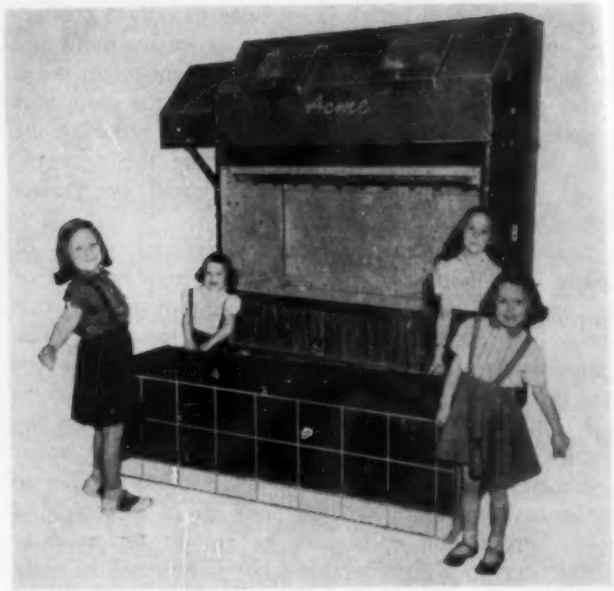
—THE END



Transparent cages fabricated from Rohm & Haas' acrylic sheet give lab workers an unimpeded means for observing animals.



Cross-sectional closeup of the polystyrene sheets shows the parallel spreader ribs and staggered turbulators.



Four little girls easily lift the Acme-Pak for a 25-ton unit. It weighs but 74 pounds, as opposed to the 539-pound steel pack formerly used.

Plastics—Real Cool!

The new Flow-mizer cooling towers produced by Acme Industries, Inc., Jackson, Mich., incorporate a new design concept based upon plastic sheets. Manufacturers of air conditioning and refrigeration equipment since 1919, the firm has come up with the Acme-Pak, which consists of multiple sheets of polystyrene held in a galvanized wire basket frame.

The first step in the manufacture of an Acme-Pak involves forming a predetermined number of high-impact polystyrene sheets into grids containing both turbulators and spreader ribs (see accompanying photograph). These serve simultaneously to separate the plastic sheets, retain the falling water, and cause turbulence in the blower-induced air stream.

Completely non-corrosive and resistant to all temperatures within the operating range, the Pak sheets allow weight savings up to 90%. A steel pack in a 100-ton cooling tower normally weighs about 2,300 pounds, whereas the plastic pack weighs but 182 pounds. To give an idea of its magnitude, a 100-ton tower has approximately 110,000 turbulators, 10 miles of spreader ribs, and over 5,000 square feet of wetted surface.

Maintenance has been simplified. "File-drawer" mountings hold the Acme-Pak, which slides out easily for inspection and cleaning. The steel frame is hot-dip galvanized on both sides to a thickness of four mils. The smaller-range towers use just one Acme-Pak with different size sheets to achieve different capacities, however, larger towers may use as many as four. Capacity range for the series is 20-200 tons. —THE END

Adhesive Bonding of Polyethylenes

(*Continued from page 990*)

tested. Based on shear strength results obtained, the acid treatment appears to be at least as effective, and possibly even more so, in improving the adhesiveness of these newer polymers.

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—THE END

Over-all view of cabana reveals the opaque, plastic-laminate walls. Plastic screening affords protection for outdoor dining.

Interior view. Not opaque panels on right, clear panels on left.

Plastic-Insulated Mobile Cabana

Plastics play a major role in the startlingly-new and attractive "mobile cabana" designed by Eric Clough, a Burlingame, Calif., landscape architect. Suitable for a variety of outdoor living uses, the cabana is a compact 440 square-foot structure containing two dressing rooms, a bathroom, and a large central room. Due to its ingenious, yet simple design it can serve as a pool-side dressing room, a guest house, or a demountable vacation house.

The walls consist of reinforced plastic panels laminated to Styrofoam insulation. These are, in turn, set into Douglas fir wood structural frames. The technique of laminating the thin glass-reinforced plastic panels to the thicker foamed insulation gives a wall of high strength, but at a price considerably lower than conventional exterior-building materials. Construction cost averaged $7.50 per square foot.

Total wall thickness is only one inch, with the two reinforced plastic "skins" accounting for 1/16-inch apiece and the insulation accounting for the other 7/8-inch. These panels are opaque, permitting light to enter from either side. One wall is covered with plastic fly-screening so that the area can be used as an outdoor dining room. As a variation, the builder could use solid panels with sliding doors of clear plastic to provide both visual and physical access to a secluded garden or sun room.

—The End

Vacuum Forming

A roundup of 1957 developments:

Edited by:
E. BOWMAN STRATTON, *President,*
The Auto-Vac Co.,
Bridgeport, Conn.

If we pause for a moment in our efforts to extend the field of vacuum forming, we find certain topics which proved to be of great interest to vacuum formers in 1957:

(1) *Better Tooling.* In the visual packaging field where the use of cellulose acetate sheet still predominates, cast plastic molds have proven less satisfactory than cast aluminum. Plastic molds tend to overheat and cause increased plasticizer mark-off. Aluminum molds tend to lose heat rapidly and develop a temperature equilibrium optimum for cellulose acetate forming. No other temperature control is needed.

Accurately-machined steel drape-assist frames as well as stripping frames are becoming commonplace with the more successful fabricators. These increase the yield of formed parts per unit area of plastic sheet, reduce the amount of scrap, and also cut down the number of rejects. Such auxiliary frames should be used in conjunction with time controls and pressure-controlled air-release devices, if they are to help increase production.

Plug forming is beginning to supersede drape forming for many heavy duty industrial parts, just as straight vacuum forming was superseded by drape-forming in 1954. Plug forming offers more economical use of material, more uniform distribution of plastic, and a greater rigidity in areas of complex contour.

Design of the plug and mold cavity require experienced attention. Temperature control of the plug is usually necessary. Deep-drawn linear polyethylene parts are now practical with plug forming.

(2) *Roll Feeding.* In forming sheet materials 0.030-inch and thinner, the economies of feeding from rolls have been fully established. Material and scrap savings in roll feed versus sheet feed have amounted to as much as 10%. Production speed has been increased up to 50%.

(3) *Heavy-Gauge Plastic Sheet Forming.* A great deal of experimentation has been carried on by all major equipment manufacturers with some positive results. The following problems must be resolved before prototype apparatus can progress to production equipment: two-sided heating versus controlled preheating from one side; equal temperature on both sheet surfaces versus differential heating of both sheet surfaces (this prevents excessive heating of the center of the sheet and sheet sag resulting from sandwich type heating). Present indications are that differential heating allows much greater material control in plug-forming operations.

(4) *Trimming.* No substitute "gimmick" has been found for accurate, adequately-powered cutting presses equipped with precision cutting dies. In specialized applications, heated dies have proven practical when incorporated into standard trimming presses.

(5) *Injection Molding versus Sheet Forming.* There have been no published cases wherein sheet forming of small parts has been competitive with thin-walled injection molding. The advantages of sheet forming continue to be based upon large area parts, relatively small volume production, low tooling costs, and versatility.

New advances in plastic sheet forming which should progress from the testing phase to production next year seem to be: plug forming; deep-draw forming; new segmented mold designs; formed polyethylene sheet control; pressure forming; and applications of formed, laminated constructions with superior heat resistance, abrasion resistance, and improved physical properties.

Profit in plastic sheet forming still depends upon good equipment which provides uniform heat, full operational controls, positive clamping, versatility, speed, and durability.

—THE END

News of the Societies

New ASID officers for the 1957-1958 term are: seated, left to right, William M. Goldsmith, president, and Francis F. Braun, vice-president; standing, Milton Immerman, treasurer, and F. Eugene Smith, secretary.

ASID Holds Annual Conference

The 13th Annual Meeting and Design Conference, held by the American Society of Industrial Designers at Ojai, Cal., ended October 20 after a four day program on the theme "Designing the Next Hundred Years". The first such national meeting of the society to be held on the West Coast, it was hosted by ASID's Southern California Chapter.

Through panel discussions many of the inter-relationships between human beings and the natural resources that support them were examined and evaluated in the light of an increasingly industry-dependent society. Topics for the various sessions included: "A New Look at Consumers, Marketing, and Product Planning;" "Supplied Design Services by Basic Materials Companies;" "Training of a Designer;" and "The Next Hundred Years". The consensus of opinion was that many fundamental changes in our living habits will take place in our lifetime, but unless destructive calamities intervene there is good reason to believe that the world will be able to take these changes without interrupting the accelerating rate of industrial progress.

The meeting was concluded with business sessions of the society and the election of officers for the 1957-1958 term. New ASID officers include: president, William M. Goldsmith, Dave Chapman Industrial Design Co.; vice president, Francis F. Braun, Product Presentation, Inc.; secretary, F. Eugene Smith, Sherr & McDermott; and treasurer, Milton Immerman, Walter Darwin Teague Associates. Mr. Goldsmith assumed the presidency from Jay Doblin, Illinois Institute of Technology, who now will act as chairman of the board of directors for the current term.

SPE New York-Newark

Members of SPE's New York section and its reinforced plastics sub-group, together with representatives of the Newark section, converged on New York City's Governor Clinton Hotel November 20, to attend the semi-annual joint dinner and meeting. Five speakers addressed the group on various aspects of finishing and thermoforming, as well as the need for quality and production control in the manufacture of reinforced plastics. Among the guests attending the conclave were Peter Simmons, SPE's national president, and Thomas Bissel, newly-appointed national secretary.

Arthur N. Skeels, Art Roll Leaf Stamping Co., talking on "Hot Stamping and Silk Screening Operation," pointed out that thermoplastic and thermosetting materials present individual problems to the decorator. Of the four methods of decorating, the hot stamping process lends itself most readily to both types of molded products with the exception of ureas and melamines. For best results, close attention should be paid to heat, pressure, dwell-time, and selection of the proper leaf. The silk screening process is adaptable to rapid production and results in an end-product having good quality and wear resistance properties. While injection molded products cannot be silk screened easily, blow molded articles can. Most of the difficulties arise from faulty mold design, resulting in a lack of dimensional tolerances and non-uniformity of gate—especially in multiple cavity molds. The mold designer and decorator should cooperate in the initial phases of product design to insure economic handling during manufacture.

In the "Evaluation of Plastics Metalizing," Harold Mesburg, Vacuum Metalizing Co., outlined the history of the process which was developed from early methods of vacuum deposition of silver nitrate on lenses to produce mirrors. He stressed the need for closer coordination between molders and metalizers in order to deliver a well finished product at a minimum cost. Too few fabricators see the object in its final form, and are unaware that metalizing will not hide imperfections. Often, minor dimensional changes in the molded item can reduce the cost of metalizing by 30-40%. A finer product can be made by breaking up surfaces with an engine—turned effect incorporated into the mold design. Sculptured and flowing surfaces also help hide imperfections, but in general, it is best to use a good quality molding material and to spend more time and effort during mold lay-out to reduce the cost of metalizing.

John Ostock, Standard Toch Chemical Co., in discussing the "Painting of Plastics Items," stated that wear and resistance properties must be built into the coating. One of the major problems in paint and lacquer formulation involves the selection of a proper solvent. It must be weak enough not to affect the coated product, yet strong enough to withstand the various other compounds with which it may come in contact such as perfumes, alcohols, soaps, and detergents. While many of the solvents incorporated into lacquers are strong enough to cause damage, the cooling effect of the spray process inhibits their action. Dispersants and wetting agents used to color plastics are troublemakers from the painter's point of view and best results are obtained with clear plastics. High impact polystyrene offers the biggest headaches since no two types are alike and crazing results from the use of conventional lacquer films. Invariably the coating must be spot formulated to achieve best results. Mold release agents also present difficulties and, when used excessively the item must be cleaned before painting. Silicone-type release agents render effective coating impossible because the large amounts of alcohol incorporated into the lacquer tend to "crawl away" from the silicone. As yet, no economical method has been devised by which it can be removed from polystyrene products prior to decorating.

Addressing the meeting on "Thermoforming Procedures," Louis H. Pfohl, Plaxall, Inc., traced the early history and development of the various processes. He recommended that the word "thermoforming" be used as a general term when referring to all methods including pressure, vacuum, tool post, matched dies, etc. He stated that precision thermoforming will find extensive applications in the packaging industry, particularly for unit portions and disposable items, and that it will be used for many industrial and building products. Thermoforming machines, of the Design Center, Inc. type, now in operation at Plaxall and other licensed companies, have a total capacity of 200-million square inches of formed products per week. Within the next five years the industry is expected to quadruple its present $25-million annual sales, and by 1967 should reach $250-million.

The reinforced plastics sub-group was addressed by William J. Eakins, DeBell & Richardson, Inc., who spoke on "Standardized Test Methods for Reinforced Plastics." Mr. Eakins pointed out that the many variables inherent in the materials and processes which go into the manufacture of reinforced plastics have made it difficult to achieve a consistent product quality. In order to overcome this deficiency, it is necessary to formulate fundamental standards and test procedures against which all raw materials, pertinent to the process, can be compared.

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SPE New York Section

"Symposium on Packaging" was the central theme of the October 16 SPE meeting held at the Governor Clinton Hotel, New York, N. Y. A guest speaker, Mr. B. D. Garware of India, spoke on the progress of the industry in that country.

Howard L. Burpo, Jr., elaborated on the "Skin Packaging Method" of applying a transparent plastic film over a product, permitting it to be attractively displayed and protected from damage. The article to be packaged is placed on a perforated backing sheet and the entire assembly acts as a mold. When vacuum is applied, air is evacuated through the holes in the backing and the plastic film is drawn tight over the article. Vinyl, cellulose acetate, and cellulose acetate-butyrate films are among the materials in current use. Once the type film and backing board have been selected, packaging reduces to a five-step vacuum forming operation including: Loading of the forming unit; preheating the film; forming the film over the product; post-heating, to activate the adhesive; and cooling and removal of the package.

Visualizing a bright "Future for Plastics in Packaging," Donald E. Westcott, W. R. Grace & Co., outlined the evolution of "technical packaging" with special emphasis on food handling. Using the Cryovac process as an illustration of current methods, Dr. Westcott explained that the material is an oriented saran-base film which is stable at room temperature, shrinks uniformly, and has low moisture vapor transmission and oxygen permeability. Food is inserted into a loose fitting Cryovac bag, air is removed, and the bag is sealed by twisting the neck into a tight cord which is secured by an aluminum clip. A momentary dip into hot water causes some of the polymer crystals to melt, allowing the molecules to pull back. In this manner, the bag is shrunk both longitudinally and transversely by as much as 30-60%. The wrinkles are removed to make the film cling to the contours of the product like a second skin. Some of the advantages cited for this method are: extension of storage life due to decreased bacterial growth; reduction of fat rancidation; and elimination of mold, freezer burn, and discoloration due to light. Other materials used in food packaging include Mylar, Du Pont's polyester film, and aluminum foil or cellophane laminated with various plastic films. With the development of low gas-permeability materials, new possibilities are opened up in the field of gas packaging. In this process, nitrogen is fed back into the package to preserve the product from oxidation.

The New York Section held its annual "year end" party a little early this year. December 11 was the date, and the place, per usual, the Governor Clinton Hotel in New York City.

News of the Industry

Starts Nylon Production

Production of nylon resins has begun at Spencer Chemical Co.'s recently-completed process and pilot plant facilities at Henderson, Ky. The installation is operated under a license agreement with Onderzoekingsinstituut N. V. Research, an affiliate of Algemene Kunstijde Unie, N. V., (AKU), Arnhem, Holland.

With the Dutch process, the company employs polymerized caprolactam to produce nylon-6, a material used for molding engineering parts, films, and bottles.

Improves Flammability Test

A flammability test unit developed by the NEMA Switchgear Committee has been installed at Continental Diamond Fibre Corp.'s plant at Bridgeport, Pa. The test equipment makes possible the accumulation of specific data on the flammability characteristics of flame-retardant laminates.

In testing, the specimen is placed within a heating coil capable of producing temperatures in excess of 860° C. Specially designed electrodes emit a constant steam of high-voltage sparks which ignite the gases rising from the heated specimen. Ignition time is taken as the interval between the instant current is applied to the heating coil and the moment the specimen bursts into flame. After a burning period of 30 seconds, all current is stopped, and the time required for the flame to extinguish itself is measured. This is referred to as burning time, and the flammability index is calculated from these values.

Promotes Employee Education

A tuition refund plan, designed to encourage employees to continue their education and training, has been introduced at Plax Corp., Hartford, Conn. Under the terms of the program, the company will pay half the tuition upon successful completion of an approved course of study.

The policy applies to regular, full-time personnel at all Plax facilities, and enables employees to take formal instruction in their work fields. Guidance for the prospective student is provided by his supervisor and the personnel department. Some of the courses available include typing, shorthand, physics, chemistry, supervisory relations, and graduate engineering.

Produces Phthalic Anhydride

A $2-million phthalic anhydride plant, located at Azusa, Cal., has been placed on stream by Reichhold Chemicals, Inc., White Plains, N. Y. At the newly-launched facility, this basic chemical is produced from naphthalene in quantities up to 10-million pounds per year. Output in excess of the company's own needs will be channeled to the West Coast's boat-building, aircraft, and construction industries.

Issues Garden Hose Standard

Commercial Standard CS209-57, pertaining to vinyl chloride plastics garden hose has been issued by the United States Department of Commerce. Necessary test procedures and requirements were developed by manufacturer members of the SPI in order to provide the consumer with a satisfactory product. A "Seal of Quality," incorporated in the standard, may be displayed on products meeting the specifications.

Expands Production Units

As part of an over-all expansion program, Plastics Fabricators, Inc., New Haven, Conn., has relocated its facilities in a new plant occupying approximately one city block. Other aspects of the program include a recently-completed plant in Havana, Cuba, and a proposed enlargement of the company's subsidiary organization in Chicago, Ill.

Acquires Plastics Plant

E. Z Paintr Corp., Milwaukee, Wis., a manufacturer of paint rollers and allied items, has purchased Keno Plastics Processing, Inc., Kenosha, Wis., and will operate the acquired firm as a division. The company will be renamed E Z Plastic Processing, Inc., and is being retooled to produce sponge plastic paint rollers and other molded plastic products.

Penny Saved, Penny Earned

A voluntary, personal thrift program for some 6,200 employees has been adopted by Diamond Alkali Co., Cleveland, O., to assist personnel toward greater economic security. The plan provides a convenient means for systematic saving through payroll deductions.

Eligible employees can save up to $3,600, or 10% of their salaries for a three year period. Savings accumulated in this manner earn a yearly interest of 5%. Upon termination of the plan in 1960, participants can collect their savings with accrued interest, or purchase a specified number of shares of Diamond common stock.

Completes Resin Plant

A processing facility for the production of Cycolac, a high-impact thermoplastic resin, has been completed at Washington, W. Va., by Marbon Chemical Div., Borg Warner Co., Gary, Ind. The plant encloses a working area of 138,000 square feet and is serviced by truck, rail, and river transportation facilities.

Expands Monomer Plant

An expansion program, which will boost the capacity of its vinyl acetate monomer plant at Calvert City, Ky., has been announced by Air Reduction Chemical Co., New York, N. Y. Output of the plant, which began operation in early 1956, will be increased from 30 to 45 million pounds per year.

Opens Chicago Branch Plant

A fully-equipped manufacturing facility to service midwestern molders and extruders, has been opened in Chicago, Ill., by Plastic Materials, Inc., Hicksville, N. Y. The new plant is part of the company's program to establish nation-wide regional facilities for the manufacture and distribution of its products which include cellulose acetate, ethyl cellulose, and compounds of cymac, acrylic, polyethylene, and polystyrene.

Consolidates Services

An expanded consulting service in plastics, fibers, textiles processing and allied industries now is offered by Drs. E. W. K. Schwartz and Irving Skeist, whose individual enterprises have been consolidated as Skeist & Schwartz Laboratories, Inc., Newark, N. J. The new organization is expected to provide more extensive facilities for sponsored research, advisory consulting, and economic and marketing surveys in the fields of polymer-textile chemistry.

Airborne Vinyl Insulation

More than 15 miles of vinyl insulated wire have been incorporated into the circuitry of the newly-designed Convair 880 jet passenger liner, which is scheduled to make its maiden flight in January 1959. The material used is B. F. Goodrich Co.'s Geon 8800, which is claimed to have exceptional heat stability and five times the insulation resistance of previously available insulators.

Expands Production Units

Plans for a $5.4-million expansion of its manufacturing facilities have been announced by the Foster Grant Co., Inc., Leominster, Mass. The program will include increases in the output of the firm's styrene monomer plant at Baton Rouge, La.; and its polystyrene, nylon, and plastic molding facilities at Leominster, Mass., and Manchester, N. H.

Expands Molding Facilities

A recently-erected molding plant in Binghamton, N. Y., has been occupied by Consolidated Molded Products Corp., Scranton, Pa. Offering 16,000 square feet of floor space, the branch unit is designed to expedite the company's services to the New York State industrial community.

Present equipment includes seven injection molding machines, and facilities for painting, buffing, hot-stamping, silk-screening, and other finishing operations. The company contemplates the addition of further plastics processing services in this location in early 1958.

Heads Technical Society

Charles H. Topping, senior architectural and civil consultant, E. I. du Pont de Nemours and Co., has been elected president of the Building Research Institute, Washington, D. C. The organization is a part of the National Academy of Sciences, and is devoted to the promotion of basic and applied research in the building field.

Diversifies Operations

Acquisition of Morton-Withers Chemical Co., Greensboro, N. C., by Chas. Pfizer & Co., Inc., New York, N. Y., was made known in a recent announcement by officials of the two firms Morton-Withers produces chemicals for the petroleum, rubber, and plastics industries, and will be operated as a subsidiary organization with no changes in management or personnel.

Vinyl Products Conference

New developments in vinyl fabricating and processing techniques will be discussed at the next conference of SPI's plastics film, sheeting, and coated fabrics division. The meeting, to be held December 10-11 at New York City's Hotel Commodore, will be based on the theme, "Quality Vinyl Products in the Consumer Field."

Paralleling the conference, a division-sponsored contest will be held for finished products made from vinyl film and sheeting. Although entries will be judged primarily on the basis of styling, workmanship, and functional value, other aspects will be considered including merchandising and packaging methods.

Acquires Machinery Company

Lynch Corp., Anderson, Ind., makers of automatic packaging and conveying equipment, has purchased the assets and facilities of Robbins Plastic Machinery Corp., Elkhart, Ind. This acquisition will be operated as a wholly-owned subsidiary to provide Lynch with facilities for producing dies, fixtures, and machinery for extruded plastics and blown films.

Enters Plastics Field

Epoxy casting and potting compounds, specially designed for use in the electronics industry, are being produced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. This diversification grew out of eight years of research with epoxy compounds, which was initiated to satisfy the encapsulating requirements of the firm's aeronautical division.

Special features of these materials include low coefficient of thermal expansion; excellent electrical insulating qualities; and high flexural strength. The four casting compounds being offered are: a general purpose, room-temperature curing compound which will harden in 20 minuntes to two hours; a high-temperature compound with a low thermal expansion coefficient and low cure shrinkage; a hermetic sealing compound, cured at elecated temperatures; and a free-machining epoxy compound that has excellent dimensional stability and high heat resistance.

Reinforced Plastics Forecast

Reinforced plastics sales should reach 168-million pounds by the end of the year, according to the results of a market study conducted by the Reinforced Plastics Division of the Society of the Plastics Industry, Inc. This represents a 20% increase over last year, and it is felt that 1958 will produce a similar gain.

The optimism is reflected by the ever increasing number of boat builders who are adding reinforced plastics boats to their lines or increasing their percentage of such molded boats. In addition, 1957 saw a number of television, phonograph, and hi-fi manufacturers introducing reinforced plastic cabinets or using these materials during tool-up. These materials also are being used in moding automobile components, public seating, and electrical hardware.

An actual breakdown of the 1957 figures shows nine major markets for the materials and the percentages accounted for by each: aircraft and missiles, 15%; appliances, 3%; boats, 15%; construction, 15%; consumer products, 15%; containers and trays, 3%; electrical, 3%; piping and tanks, 2%; and transportation, 20%. Miscellaneous applications accounted for the other 9%. Broken down in a different fashion, we find polyester resins accounting for half of the total poundage (84-million pounds); and reinforcements, fillers, and pigments accounting for the other half.

The total increase was fairly well distributed throughout the major fields of use; the exceptions being consumer products, which showed a spectacular increase, and aircraft and appliances which declined in volume. Outboard motor housings and furniture accounted for the major increase in consumer products, although sports goods represent a large percentage of the total. Appliance and aircraft markets were slow throughout the year, and the decrease in the amount of reinforced plastics used here only reflects the general trends of these two industries.

The appliance market is, however, staging a comeback and this industry is considered among the most promising for reinforced plastics in 1958. Molding materials and premixes are expected to play an important role, especially in cabinets where form, finish, and color can be achieved in a single molding operation. In addition, these materials offer manufacturers of such products as portable TVs the important advantage of insulation against electrical shock. Laundery tubs, water softener cabinets, and air conditioner housings also should account for a considerable share in this anticipated gain.

A greater use of reinforced plastics in missiles should take up the slack in the aircraft and missile market as soon as these projectiles move from the research to the production phase. It has been predicted that RP materials will make up as much as 85% of the airframe weight in the newer type missiles. They are currently used in rocket motors, fins, radomes, and other components.

Paneling, both flat and corrugated, account for most of the reinforced plastics going into the construction field. New and anticipated usages include sandwich curtain walls, coated concrete blocks and ceiling tile, waffle pans for the forming of concrete, and entire building structures such as the Home of the Future in disneyland.

The amount of reinforced plastics used in the transportation field (16½-million pounds) is readily understood when one considers that a RP timing gear, used in the majority of new automobiles, requires 1½ pounds of material. Were other cars than the Corvette to use reinforced plastic

these four applications are improved with

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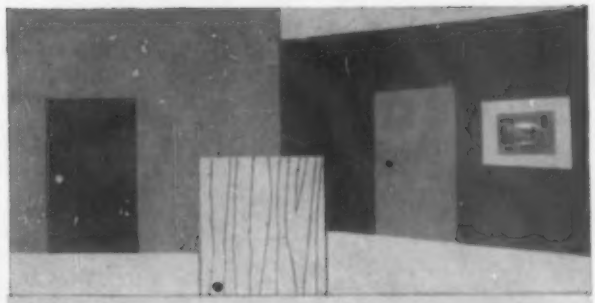

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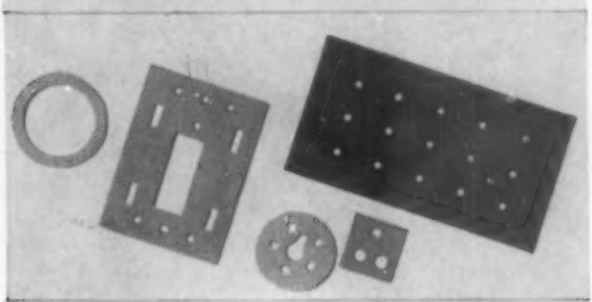

INDUSTRIAL LAMINATES made with DAPON resin have a number of outstanding properties: Superior electrical properties e.g., high insulation resistance retained under conditions of high humidity; heat resistance without degradation even under sustained vibrational stress. Other advantages exist in end uses requiring a high degree of chemical and moisture resistance, good dimensional stability, mechanical strength and ease of machinability. Formulated with or without volatile solvents DAPON resin is suitable for use in the full range of pressure curing conditions.

MOLDED ELECTRICAL PARTS containing DAPON resin exhibit highest resistance to humidity changes. Maximum retention and rapid recovery of electrical properties are insured by the unmatched stability of DAPON resin and the absence of deleterious products of degradation under long term use conditions. Properties of dielectric strength, dielectric loss, volume resistivity and arc resistance are particularly outstanding. Very low molding and post molding shrinkage allow close tolerances and the use of closely spaced inserts. Moldability and resistance to heat and chemicals are excellent.

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bodies, this figure would jump tremendously.

The achievements of the reinforced plastics industry are, in a large measure, due to the constant research being conducted in the development of new and improved resins and reinforcements. Molding materials and premixes have provided much of the impetus by permitting faster production cycles with non-critical parts.

Packaging Institute Forum

The Packaging Institute held its 19th Annual Forum on October 28-30, at the Statler Hotel in New York City. Representing approximately 700 of the country's leading corporations in the packaging field, the Institute held a number of concurrent seminars featuring a roster of over 60 speakers. A number of talks covered plastics, and abstracts of them are given below:

"Poly on Mylar Vacuumized—A New Skin-Packaging Film" was described by Benjamin Lechner and Peter C. Hitt, Print-A-Tube Co. P.O.M.V. is a combination of polyethylene and specially-treated Mylar polyester film, which permits the use of uncoated and unperforated paperboards in vacuum skin-packaging. Approximately the same price per square inch as existing films, it reduces the cost of usable paperboards. In addition, its mechanical characteristics permit a speeding-up of the packaging cycle and thus open the door to automation to skin packaging.

"Fiberglas Reinforcements for Packaging Materials" was covered by William J. Clark of Owens-Corning Fiberglas Corp. He pointed out that the unique properties of Fiberglas textile products have made them a major component in reinforced packaging, construction papers, gummed sealing tapes, and pressure sensitive tapes. They reportedly show promise in the reinforcement of extruded films, and in the integral reinforcement of paper sheets by the addition of glass fibers to the pulp.

"Genetron Plastic Film and Tubing in Packaging" was discussed by Robert Kurtz, Unette Corp. This versatile thermoplastic is used in the packaging of critical pharmaceutical and cosmetic compounds.

"Kel-F-Halo-Fluorocarbon Plastics for Packaging" was the topic presented by Minnesota Mining & Mfg. Co.'s H. S. Kaufman, J. H. Kushnick, and R. A. Smith. Available in the form of sterilizable tubes, films, and moldings, Kel-F plastics offer the pharmaceutical industry a unique packaging material. They are heat-sealable by thermal impulse or electronic sealing; are optically clear, flexible, and tough; have practically no alcohol, water, or oxygen permeability; and may be ink marked or hot stamped for identification. They have been used in suture packagings, parenteral solutions, ampules, hypodermic syringes, vacuum formed pouches, and bottles.

Adds Manufacturing Facilities

Allied Chemical & Dye Corp.'s Semet-Solvay Petrochemical division has added to its manufacturing facilities in Buffalo, N. Y. This expansion was dictated by the increasing demands for Atomized A-C Polyethylene, especially the very small particle-size grades, 6A and 617A.

The above-mentioned grades are used extensively by the plastics industry, wax blenders, ink manufacturers, rubber compounders, and manufacturers of paint, varnish, and lacquers. Easy to melt and mix, these grades adhere readily to other materials in a dry blending operation.

Plastics processors add A-C Polyethylene to color concentrates and base resins, thus insuring proper melt and integration in the final part. Shorter operating cycles, lower temperatures, lower operating pressures, and ease of fill in multi-cavity molds are reported by users. Finished articles are said to have better color dispersion, and will release easily from the shiniest molds.

Hotels Switch to Plastics

The coming year should see even more hotels switching to the more durable vinyl wall coverings for their miles of interior walls, according to spokesmen for Velveray Corp., a leading New York manufacturer. Highlighting this trend, it was announced that Cuba's new multi-million dollar Havana Riviera Hotel had installed the firm's Velvetex vinyl wall covering throughout its rooms and halls.

Velvetex is actually a laminate of sheet vinyl and woven cotton. For hotel use, it comes in triple-weight (15-mil) vinyl, deeply embossed with three-dimensional patterns. Twelve pastel colors, both plain and printed, are available, and decorative designs run the gamut from colonial to modern.

Other Velvetex walls have been installed or ordered by the Tropicana in Las Vegas; the Williamsburg Motel in Williamsburg, Va.; Essex House, New York City; Bedford Springs, Pa.; DeSoto, Hot Springs, Ark.; and the Shoreham in Washington, D. C. Durable and washable, the wall covering is favored by hotel architects in ever increasing numbers.

Du Pont Expands Belle Works

A recent expansion of its Belle Works in West Virginia has enabled Du Pont to produce Hytrol O cyclohexanone with a minimum purity of 99.3%. A ketone, the material is a chemical intermediate free of by-product producing contaminants. It is used in the production of adipic acid, and as a solvent for DDT, PVC, and most organic materials.

The cyclohexanone facilities result from the over-all modernization program now under way at the Belle Works. The plant's high pressure synthesis facilities are being converted to use natural gas instead of coal as a basic material. Completion is expected by 1959.

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Names in the News

Robert T. Browning

Robert T. Browning has been named executive vice president of Wallace & Tiernan, Inc., Belleville, N. J. He has been associated with the firm since 1930, beginning as a field engineer. For the past four years, Mr. Browning has held the position of vice president in charge of sales for the three chemical divisions, as well as the sales and engineering activities of five equipment divisions and subsidiaries.

Jerome T. Coe has been appointed manager of marketing for General Electric Co.'s silicone products department. He replaces **T. C. Ohart,** who has become general manager of G E's insulating materials section.

Ross D. Spangler, research physicist at Du Pont's polychemicals department, has been promoted to senior research physicist. Dr. Spangler will continue work on the physical and mechanical properties of plastics.

Phillip B. Watson has retired as plant manager of American Cyanamid's Wallingford plastics plant after 32 years of service. **Daniel McC. Collette** succeeds Mr. Watson, who will continue to serve in a consultant capacity. Mr. Collette joined Cyanamid in 1941, and has been a plant manager in Niagara Falls; Azusa, Calif.; and Welland, Ont.

Karl N. Carter has been appointed vice president in charge of sales for H. O. Canfield Co., Bridgeport, Conn. He is a former vice president and general sales manager of the Ohio Rubber Co.

A. K. Hoge has been appointed special representative for the Boston Office of Goodyear Tire & Rubber Co.'s chemical division. Mr. Hoge has over 16 years experience in engineering research and development.

John B. Lidstone has been appointed field representative for General Electric Co.'s chemical materials department in Western New York.

Joseph J. Laputka has been appointed assistant treasurer of Escambia Chemical Corp., New York, N. Y. He formerly served as vice president and treasurer of R. M. Hollingshead Corp.

Howard S. Bergen, Jr., former technical sales specialist on plasticizers, has succeeded **Howard I. Armstrong** as sales manager of plasticizers and resin materials, Monsanto Chemical Co.'s organic chemicals division. Mr. Armstrong has been appointed divisional sales manager in Chicago, Ill. **August R. Hempel** takes over a vacancy created by the promotion of **H. James Lawler** to assistant directorship of sales in St. Louis.

Leo Bernstein, Gertrude Gilman, and **Pasquale Bilello** have been added to the chemical staff of Evans Research & Development Corp., a New York independent chemical consulting laboratory.

A. L. Wooten has been appointed technical director, New England division, for Reichhold Chemicals, Inc. He will make his headquarters at the plant in Ballardvale, Mass.

Finn Claudi-Magnusses has been appointed materials and process engineer for Narmco, Inc., San Diego, Calif. He formerly served as an applications chemist for General Aniline & Film Corp.

Richard D. Satava has been made a plastic materials sales representative for B. F. Goodrich Chemical Co. He will make his headquarters with the Cleveland sales district.

Kenneth C. Towe, president of American Cyanamid Co. since 1952, has been elected to the newly-created post of chairman of the board. **Wilbur G. Malcolm,** former vice president in charge of marketing, has been elected president and chief executive officer of the company. Another vice president, **Kenneth H. Klipstein,** was elected to the board of directors.

M. E. Wendt

M. E. Wendt has been appointed manager of chemical materials and products development for Goodyear Tire & Rubber Co. He will be responsible for the development of new products, applications, and both field and production service.

A. H. Ingley, Diamond Alkali vice president in charge of manufacturing, has been appointed to the newly-created position of senior vice president. **James A. Hughes,** company treasurer, has been advanced to another new post—vice president of administration. The firm's secretary, **Donald S. Carmichael,** has been made general counsel. R. H. Armor, assistant treasurer, replaces Mr. Hughes as treasurer.

Jack L. Wilson, R. W. Ostermayer, Jr., P. O. Bowers, and **L. J. Reizenstein** have been elected vice presidents of Pennsylvania Industrial Chemical Corp., Clairton, Pa.

Donald W. Rice has joined the polymer section of Monsanto Chemical Co.'s research & engineering division at Dayton, O. He previously served with Leland Electric Co. **Henry F. Spadoni, Jr.,** has been added to the firm's Resinox department in Springfield, Mass.

Harold W. LeBoeuf has been appointed manager of intermediates operations and **Richard D. Rice** becomes manager of rubber and polymer operations for General Electric's Silicone Products department. Mr. LeBoeuf joined GE in 1940, and has served as general foreman and manager of materials. Mr. Rice has been with the firm for six years as silicone process engineer and foreman.

Orville W. B'Hymer has been named to the newly-created position of customer service manager, Fatty Acid sales department, for Emery Industries, Inc. Since joining the firm in 1947, Mr. B'Hymer has been assistant to the sales manager.

Ernest E. Holdman has been elected vice president and general manager of Heyden Newport International, a newly-formed division of Heyden Newport Chemical Corp. **Clement H. Horst** has been appointed assistant vice president in charge of naval stores products for export. **Richard H. Boggs** has been named sales manager for export chemicals.

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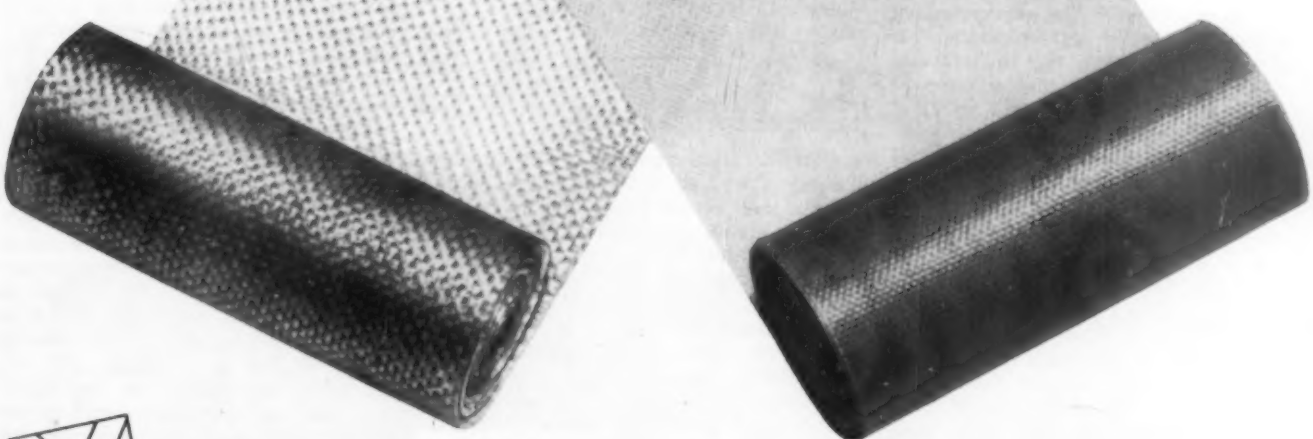

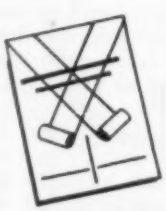

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News from Abroad

Plastics in Portugal

The Portugese plastics industry is still in the early stages of development, consisting of four producers of phenolic and casein materials and 44 processors, located principally in Lisbon and Oporto. Plastics are gradually replacing certain items made of glass, wood, and metal, and trade sources are optimistic over the potential market for the industry's products within the country and its overseas provinces.

In 1954, approximately 708 metric tons of plastics materials were consumed; 80% of which were of foreign origin, primarily from Great Britain. Domestic production for that year amounted to 130 tons of phenol-formaldehyde powder and casein sheets and rods.

Imports of plastics materials are controlled, and import licenses are granted only when the item is not available at competitive prices, or not available at all. In 1955, 26 molding machines were imported, 23 coming from England, while the remainder originated in Germany. Higher prices and need for dollar exchange have prevented the importation of American machinery and materials. No specific controls govern the manufacture of plastics products, with the exception of electrical items. However it is reported that manufacturers are pressing the government for the creation of a national plastics guild to regulate the entire industry.

Plastics in Panama

The Panamanian plastics industry comprises one fabricator, and several establishments for the decoration of films to produce seat coverings and other items used in interior decoration. While the quality of the end products is not comparable to those made in the United States, the higher unit price of finished imports has been an inducement for domestic fabrication.

The company engaged in fabrication reports a monthly consumption of 6,000 pounds of plastics films, which are converted into finished bags and covers. There is also a small output of table cloths and shower curtains.

Panama depends entirely upon imported raw materials, most of which are supplied from sources within the United States. Plastics materials are classified under Article 8 of the customs tariff and are dutiable at the rate of 15% ad valorem. To this duty must be added a consular invoice fee of 5% of the f.o.b. port of embarkation value of the merchandise plus a tax of two cents on each bundle, package, case or box regardless of size or weight.

Forms Belgian Subsidiary

A subsidiary organization, called Capital Plastics Europe S. A., has been formed in Brussels, Belgium, by Capital Plastics, Inc., Rochester, N. Y. Initially, the company will draw on a large inventory of materials at Antwerp to provide sales service to the parent firm's European customers. Later, the company will expand into processing and finishing, and finally will undertake the manufacture of synthetic pearl plastic material.

Names Foreign Distributor

Versamid polyamide resins will be distributed in Western Germany and Austria by Shering A. G. Berlin, of Berlin, Germany, according to an announcement by the chemical division of General Mills, Inc., Kankakee, Ill. The German firm will market the resins through its industrial chemical organization, having long been a leader in the chemical and pharmaceutical fields.

Licenses European Firm

Phenolic resin products, developed by Catalin Corp. of America, New York, N. Y., will be manufactured in Europe under a license agreement with Cie Centrale Rousselot, Paris, France. The five-year agreement gives the French company access to Catalin's technical information on the manufacture of solid one- and two-stage phenolic resins for adhesive, bonding molding, and foundry uses.

Rousselot is permitted to manufacture in Sweden, Switzerland and the NATO countries. It will reimburse Catalin on a royalty basis in addition to supplying information on any new processes that may develop in the areas under agreement.

Moplen Produced Commercially

An improved polypropylene thermoplastic called Moplen (R), now is in commercial production at the Ferrari plant, Montecatini Societa Generale, Milan, Italy. The material has a heat resistance in excess of 300° F.; excellent resistance to grease, oil, and water; high electrical properties and impact strength; and is inert to many common acids.

The material is made by a low pressure process using catalytic agents which act on the olefins to produce an exceptional regularity of structure, and permit the control of crystallinity in the synthesized polymer. The basic process discovery is said to be applicable to other alpha-olefins which, prior to this time, have been predominantly amorphous in structure with an uncontrolled degree of crystallinity.

Aluminum-plastic Composition

The French firm, Aluminum Francais, has taken out a patent for the manufacture of a composition consisting of a phenol-formaldehyde molding powder containing a fairly high percentage of rather coarse aluminum granules. The material, to be known as Etalu, is reported to have given satisfactory results when tested in road markers and studs for crossings, and will be produced on a commercial scale. Tests apparently also have been carried out with combinations of aluminum granules and other plastics, both thermosetting and thermoplastic materials having been included.

Irradiated Polyethylene Wire

Limited production has been started by Mersey Cable Works, Ltd., in Great Britain, of a new equipment wire utilizing irradiated polyethylene as the insulation. This new product, known as "Merad," is the result of prolonged investigation at the Hinxton Hall laboratories of the Tube Investments Group. It was found that compounds of normal polyethylene and chemical modifiers exposed to high-velocity electron bombardment by a Van de Graaf particle accelerator suffered no impairment of dielectric properties. At the same time, molecular cross-linking induced by irradiation caused the maximum continuous operating temperature of the material to rise from about 85° to 100° C. with short-time operating temperature around 150° C. This development permits soldering to be carried out right down to the insulation, and the use of polyethylene cable where high external temperatures are experienced. Momentary overloads, responsible for damaging or destroying normal polyethylene insulations, merely result in the conversion of Merad to a rubber-like substance that retains some useful strength up to a temperature of 450° C.

As to other physical properties: irradiated polyethylene is free from stress cracking in the presence of detergents; resistance to aromatic and aliphatic hydrocarbons is increased; tensile strength, elongation and abrasion resistance are improved; and handling and flexibility are practically unchanged.

The new material is expected to prove useful in sleeving and encapsulation applications. Irradiated sleeving can be cold-distorted to a larger inside diameter (from ⅛-1/5 inch or more) to fit over terminals or components. Under momentary heating to 135-150° C., it tends to regain its original inside diameter, thus encapsulating the terminal or component.

Plastics in Pakistan

The plastics products industry has developed quite rapidly since the partition of Pakistan in 1947, although no factories existed before that date. According to a report by the Pakistan Tariff Commission, there were 89 concerns producing plastics goods in 1952. Of these, 16 were considered relatively large scale operators, while the remaining 73 were on a cottage-industry basis using locally-produced, hand-operated molding machines. A later report boosted the estimate of total producers to 175, 25 of which were called large scale.

The larger factories have imported injection molding machines and compression and extrusion equipment. Some firms are engaged in the blow-molding of polyethylene bottles and toys, while others produce electrical switches, ceiling roses, pendant holders, pens, combs, soap boxes, toothbrushes, buttons, beads, tumblers, and bracelets. One firm, manufacturing PVC-coated textile materials, reportedly has an annual production valued at $210,000.

Only molding materials are used in significant quantities, and trade sources report an annual consumption of 1,000 long tons. Pakistan's tight foreign exchange limits full utilization of present capacity which reportedly would require some 3,000 long tons annually.

To encourage export, the government has included finished plastics goods under Export General License No. 7, and under the Export Incentive Scheme which permits the exporting firm to use a certain percentage of its earned foreign exchange. However foreign trade potential is limited by Pakistan's stringent import restrictions of plastics materials and the fact that domestic demand for these products is not fully satisfied.

Upon recommendation of the Tariff Commission, the government has extended protection to the plastics industry for a three-year period ending March 10, 1958. The following measures have been taken:

1. Imposition of a protective duty of 60% ad valorem on switches, and 50% ad valorem on plugs, cutouts, ceiling roses, and pendant holders.
2. Conversion of the revenue import duties into protective duties on combs, hair slides and grips, bangles, toothbrushes, soap boxes, buttons, conical tubes, and pens.
3. Abolition of the customs duty of 37½% on molding powders.
4. Granting full rebate of duty paid by pen manufacturers on the import of fountain-pen nibs, gold-plated nibs, and refills.
5. Provision of technical assistant and advice by the Department of Supply and Development to factories manufacturing electrical accessories and fountain and ball-point pens.
6. Requiring government departments and canteens to purchase domestically produced plastics goods.

Polyflex Products in Belgium

Sidaplex S. A., a recently formed Belgium firm with headquarters in Brussels and plant in Ghent, will produce blown bottles and similar hollow goods from polystyrene as well as Polyflex oriented polystyrene foils.

This company will be the first outside of the United States, to produce the Polyflex foils, a product of Plax Corp., Hartford, Conn. The American concern and a leading Belgian plastics firm, Societe Industrielle de la Cellulose, Brussels, will participate in the capital of Sidaplex, put at 35,000,000 Belgian francs.

PVC Plant for Argentina

Electrocolor S.A.I.C., an Imperial Chemical Industries enterprise in Argentina, expects to build a large new PVC plant at Capitan Bermudez, near Rosario, Argentina. Initial annual capacity of the plant will be 4,000 tons, but provision has been made for expansion to meet the country's growing needs. I.C.I. company designed the plant and will train the technical staff to operate it.

The undertaking will require a capital of about 150,000,000 Argentine pesos, which will be supplied for the most part by Industrias Quimicas Argentina "Duperial" S.A.I.C., a subsidiary of I.C.I., and Celulosa Argentina S.A.I.C., the chief shareholders of Electrocolor. Participation later by Argentine investors also is planned.

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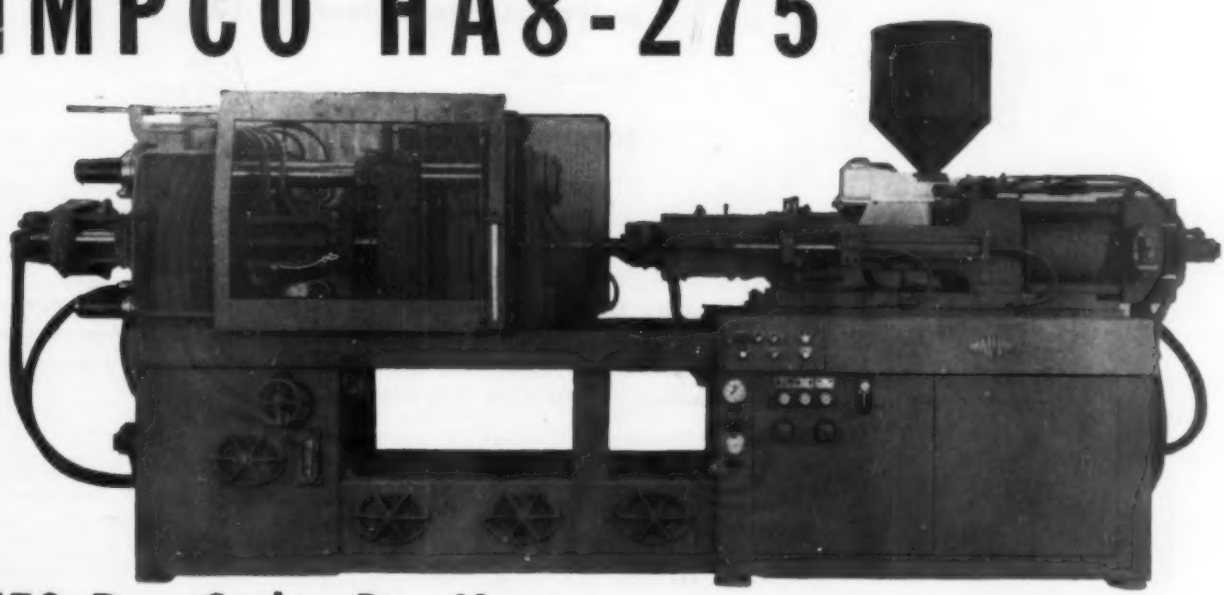

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New Materials

Write item numbers on Readers' Service Card to obtain more information.

Urethane Cross-linking Agent

A polyurethane cross-linking agent, plasticizer, and surfactant has been made by Dow Chemical Co., through the interaction of propylene oxide and sucrose. Called Hyprose SP80, the viscous, yellow-amber liquid is chemically octakis (2-hydroxypropyl) sucrose.

Hyprose SP80 can be added to polyglycols after the prepolymer reaction to produce low density foams with high load-bearing characteristics and good resiliency. As a plasticizer, the material may be used with such cellulosic materials as paper, cellophane, and methylcellulose. It is said to impart better dimensional stability, greater permanence on aging, and has less tendency to lower the tensile strength of the cellulosics.

The material has an APHA color of 500, a viscosity of 590-660 cps., a specific gravity of 1.16-1.18, and a maximum volatility of 3% after one hour at 145° C.

Readers' Service Item M-1

Melamine-Bonded Glass Sheet

A continuous filament, woven-glass bonded with a melamine resin has been introduced by Synthane Corp. Designated Grade G-5, the material offers high tensile, flexural, and compressive strengths; heat resistance; and resistance to flame and arcing. Properties are reported as follows:

Tensile strength, psi. lengthwise	37,000
Crosswise	30,000
Compressive strength, psi. flatwise	70,000
Edgewise	25,000
Flexural strength, psi. lengthwise	44,000
Crosswise	48,000
Modulus of elasticity in flexure, psi. lengthwise	1,700,000
Crosswise	1,500,000
Shear strength, psi.	20,000
Hardness, Rockwell M.	120
Impact strength, Izod, ft. lbs./in. notch, flatwise	12
Edgewise	5.5
Specific gravity	1.9
Coefficient of thermal expansion x 10^{-5}	1
Water absorption, 24 hrs., ⅛-inch specimen, %	2
Dielectric strength, perp. to laminations, short time, 1/16-inch specimen, VPM	350
Dissipation factor, 1 megacycle	0.02
Dielectric constant, 1 megacycle	7.8
Insulation resistance, megohms	100
Arc resistance, sec.	180
Maximum constant operating temp., °F.	300
Bond strength, lbs.	1,570
Thickness, max. in.	2
Min. in.	0.6
Standard color	Gray-Brown
Standard finish	Semi-Gloss

Readers' Service Item M-2

Semi-Rigid Polyester Resin

A medium-viscosity, semi-rigid type polyester reportedly featuring good impact strength combined with high strength has been introduced by Hooker Electrochemical Co. Called Hetron 33, the material is an excellent molding resin, especially for matched die molding. Laminates are said to be strong, stiff, and resist cracking.

Self-extinguishing, Hetron 33 laminates can be baked at 350° F., for 90 minutes several times without cracking. Property data are reported as follows:

Viscosity, poises	13–17
Color, Gardner	3
Specific gravity	1.27
Shelf life, room temp., months	6
Gel time, SPI, min.	5–6
Shrinkage on cure, unfilled, volume %	6.2
Heat distortion point, °F.	183

The following properties are reported for 1/10-inch laminates containing 40% glass mat, 15% filler, and 45% Hetron 33:

Flexural strength, psi.	40,900
Flexural modulus, psi. x 10^6	1.6
At 180° F.	1
Tensile strength, psi.	21,500
Tensile modulus, psi. x 10^6	1.7
Flexural strength and modulus retention after 24 hrs. boiling water, %	91
Water absorption, %	0.1
Hardness, Barcol	55–60

Readers' Service Item M-3

Water-Soluble Polyethylenes

A series of water-soluble, high molecular weight polymers of ethylene oxide has been introduced by Union Carbide Chemicals Co. Reportedly ideal for such diverse applications as packaging film and warp size for textile yarns, these new materials are trade-marked Polyox.

Polyox resins can be cast, calendered, or extruded into tough, flexible films. At low concentrations, they have greater thickening power than any material now on the market. They resist moisture pickup in dry forms, and are resistant to oils, greases, and biological attack. Compatibility with other polymers such as starch and PVA is reported.

The highly crystalline resins range in molecular weight from a hundred thousand to several million. Along the upper range, they have exceptional thickening power in solution at room temperature. A 1% water solution has a viscosity of 460 poises; as compared with 20 poises for the highest-molecular-weight grade of sodium alginate, four poises for hydroxyethyl cellulose, and 12 poises for the highest-molecular-weight grade of carboxymethyl cellulose.

Water solutions are highly dependent upon shear, and their viscosities decrease with an increase in shear. This "pseudo-plasticity" is reversible, provided shear rates are not sufficiently high to rupture the largest molecules. In solution, they also have a ropy consistency which should make them of considerable value in adhesive formulations.

The standard two-year toxicological feeding tests are not completed; however, preliminary 90-day feeding tests indicate that Polyox resins have low toxicity. This feature, combined with their extreme solubility, suggests their use as food packaging films which could be dropped directly into the boiling water.

Polyox resins are produced as white granules in four grades: WSR-35, WSR-205, WSR-301, and WSR-701. In addition, a special textile warp sizing grade is available. At present, five-, 25-, and 50-pound containers are obtainable in limited quantities.

Properties for WSR-205 are reported as follows:

Melting point, °C	65-67
Brittle temperature, T_b, °C	—50
Ash content, max., wt.%	2
Odor	Mild
Moisture content, %	1.5
Particle size, mesh	10
Viscosity @ 25°C., 5% aqueous solution, cps.	1,500-2,500
Melt viscosity @ 150°C., poises	23,000-26,000
Tensile strength, psi.	1,800-2,400
Yield strength, psi.	1,300-1,500
Ultimate elongation, %	1,100-2,000
Tensile modulus, psi.	35,000-40,000
Hardness, Shore A	99

Readers' Service Item M-4

Mastic for Plastic Foams

A high-strength, quick-grab, trowelable mastic for bonding rigid and semi-rigid plastic foams has been introduced by Rubber & Asbestos Corp. Called Bondmaster G458, the mastic also finds use as a general purpose adhesive wherever a high-static waterproof bond is required.

The base for Bondmaster G458 is reclaim rubber, which is incorporated into a special solvent blend. This solvent system is specially formulated to minimize or eliminate cell collapse on the surface of foamed styrene. Surfaces to be bonded must be clean, dry, and as level as possible. The mastic is spread with a sawtooth spreader, notched trowel, or spatula. Parts can be mated almost at once, and must be mated within 10-15 minutes.

The mastic's color is black, and its weight is 9.5 pounds per gallon. It contains about 70% solids, and has a storage life of at least one year. The solvents recommended for clean-up are toluol and naphtha. Five- and 55-gallon containers can be supplied.

Readers' Service Item M-5

Synthetic Fiber Blankets

Mechanically bonded blankets of Dacron and Orlon, designed specifically for the plastics laminator, have been introduced by Troy Blanket Mills. Called Troytuf, these materials are said to offer excellent deep draw, tailorability, ease of handling, and machineability.

The Dacron polyester blankets are recommended for most applications, and the Orlon acrylic blankets are offered for laminates which would be exposed to extreme weather conditions or which would be painted. Standard widths for both materials are 36, 54, 72, and 108 inches; standard weights are 4.5 and nine ounces per square yard.

Data will be given, showing the materials to be superior to glass. This does not mean, however, that Troytuf is actually superior to or can be substituted for glass in any usage. The synthetic blankets are intended for specific applications, and often are used in combination with glass reinforcements. Troytuf makes an excellent laminate overlay, where a smooth, abrasion- and chemical-resistant surface is required. Fine, uniform, and white, the fibers are masked completely by resins of any color.

Troytuf laminates showed 200-700% better abrasion resistance to comparable laminates reinforced with glass alone. Electrical properties, wet or dry, also are reported to be superior to those for laminates using only glass. Although lower in total flexural strength, Troytuf laminates permitted greater and more severe flexing without damage or degradation. A Dacron blanket is approximately 54% lighter than an equal volume of fibrous glass. Neither blanket, however, equalled glass in tensile, compressive, and impact strengths.

Readers' Service Item M-6

VANSTAY Z

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Two Specialty Resins

Two new resins have been introduced by Pennsylvania Industrial Chemical Corp.: one, a modified styrene for use in gold-bronze vehicles; and the other, a polyindene resin for use with aluminum paints.

Piccolastic Bronze Vehicle is reported to be completely neutral, unreactive, and color stable. Supplied as a highly viscous solution, it is non-gassing with all available bronze pigments. Maximum flotation is assured by proper solvent selection, and the vehicle shows no tendency to gel on storage. Properties follow:

Non-volatile content, %	51-53
Viscosity, Gardner	Z_1-Z_3
Color, Gardner	<5
Weight, lbs./gal.	7.93
Acid number	<1

Picco Resin 420-ES is said to impart improved and retained leafing qualities to aluminum paints. Non-gassing, it is compatible with ordinary petroleum thinners. The resin is available flaked, solid, and in solution with mineral or HiSolv spirits. In any form, it is highly compatible with drying oils, bodied oils, alkyds, and oleoresinous varnishes. Properties are:

Color, coal tar	3-5
Melting point, B&R, °C	100
Viscosity, Gardner-Holdt,	
60% in mineral spirits	L-N
70% in mineral spirits	Z_1-Z_2
Weight, 60% in mineral spirits, lbs./gal.	7.8
70% in mineral spirits, lbs./gal.	8.2

Readers' Service Item M-7

Chemical Resin-Intermediate

High purity Enjay Dicyclopentadiene, a chemical intermediate used in resin production, can be obtained in bulk from Enjay Co., Inc. Clear and free from entrained matter, the material weighs approximately 8.2 pounds per gallon.

Specifications are reported as follows:

Minimum dicyclopentadiene content, wt. %	95
Maximum di(methyl cyclopentadiene) content, wt. %	3.5
Acyclic dienes content, max. wt. %	2.5
Higher cyclic dienes, max. wt. %	0.3
Specific gravity	0.97–0.985
Color, Gardner	1
Inhibitor content, max. ppm.	250

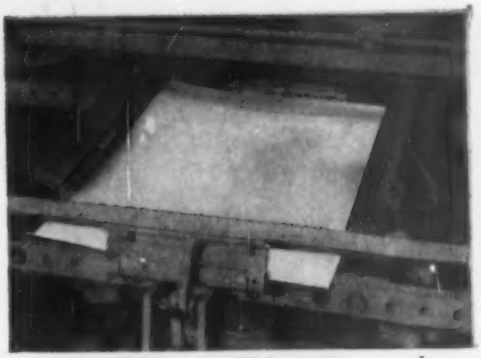
Readers' Service Item M-8

A TECHNICAL REPORT FROM DU PONT

Advantages of

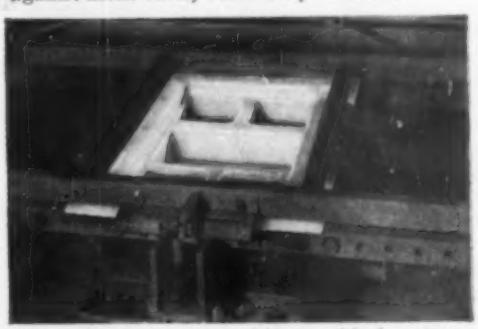
ALATHON® 31
POLYETHYLENE RESIN

for thermoforming



Sheeting of ALATHON 31 in position on clamp frame prior to heating process.

Heated sheet is pushed into mold cavities by forming assist plugs, then drawn off plugs and against mold-cavity surface by vacuum.



Formed piece cools quickly in mold after assist plugs have been raised.

Piece is removed from forming machine and ready for trimming.

• ALATHON 31 is a pure polyethylene resin of high density, low melt index, and narrow molecular weight distribution. Designed by Du Pont specifically for the extrusion of heavy sheet used in thermoforming, ALATHON 31 is unexcelled for items formed from sheet material.

Since ALATHON 31 is designed to be very viscous in the molten state, it overcomes the problem of sag during the heating step prior to thermoforming. This high viscosity, however, presents no problem in the manufacture of the sheeting, or in the forming of the sheet. Tailor-made to provide the optimum combination of stiffness, extrudability, minimum sag at forming temperature, minimum cooling time in the mold, and the ability to conform to the detail in the mold cavity, ALATHON 31 opens a new approach to the manufacture of all kinds of packages, housewares, toys, laboratory equipment and similar products. Mold temperatures approaching 190°F. may be used with ALATHON 31 with little increase in cooling time on the mold. Advantages of high mold temperature are less likelihood of mark-off and improvement in stiffness.

The greater stiffness of ALATHON 31 can be used to enhance the final molding, or it can be used to lower costs by reducing the wall thickness of the object. ALATHON 31 provides attractive glossy surfaces and is exceptionally resistant to environmental stress cracking. Because it is virgin polyethylene, ALATHON 31 is free from taste and odor, and is completely non-toxic. For more property and application data on this unique new resin, simply clip and mail the coupon below.

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IN CANADA: Du Pont Company of Canada (1956) Limited, P. O. Box 660, Montreal, Quebec.

New Equipment

Write item numbers on Readers' Service Card to obtain more information.

Perma-Grit abrasive disc being used to smooth edges of plastic windshield.

Abrasive Tool Line

A new line of abrasive tools including circular saws, rods, files, sleeves, plates, and discs has been introduced by Skil Corp. Employing an exclusive process, Skil brazes tungsten-carbide grits to a steel surface. The firm feels that its new Permagrit T-C abrasive will make sandpaper obsolete in many industrial abrasive operations.

The circular saw blade reportedly cuts plastic without crazing, chipping, or melting the material. One firm reports that production costs are cut to one-sixth by substituting Skil's abrasive plate for cloth-backed sandpaper discs. Another fabricator smoothed the edges of 3,500 plastic windshields for pleasure boats with a single disc.

The abrasive tools remain relatively cool during operation, since the conducting steel base absorbs and dissipates frictional heat. The saw has grits brazed to the sides as well as to the rim, with the result that it is capable of cutting on three surfaces. Should it gum or otherwise load during long-time use, it can be cleaned with solvents and/or a wire brush.

Nine grits are available, ranging from the coarse No. 24 to the very fine No. 220. Abrasive rods for spindle sanders are offered in 1/8-, 3/16-, and 1/4-inch diameters. Sleeves are marketed from 1/4-inch diameter up. The grit wheel is an eight-inch disc with a 5/8-inch arbor.

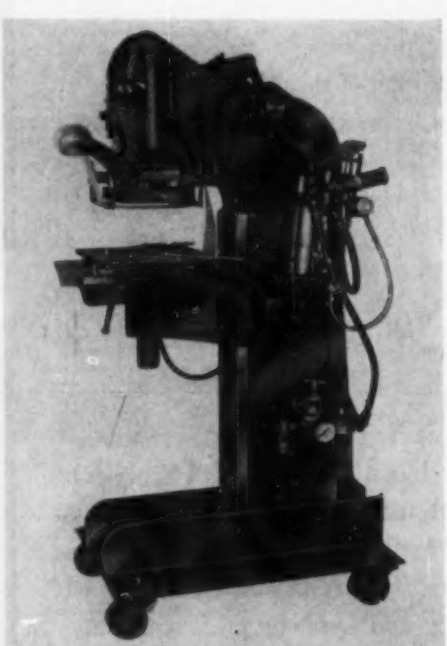
Readers' Service Item E-1

Roll-Leaf Stamping Press

Another air-operated, roll-leaf stamping press has been introduced by the Olsenmark Corp. Called the Kensol 110, the unit is designed to handle flat items and others up to 24 inches high by simple adjustments of the table. It is available with one or two main air-operated cylinders, and with either six- by nine-inch or nine- by 12-inch impression areas.

The work table slides manually, and can be obtained in dimensions of 12 by 14 inches or 18 by 18 inches. The head stroke is three inches, and the maximum opening from die or type to table is 27 inches with head in "up" position. Depth of throat is 7½ inches from center of head to frame, with the result that the center of a 15-inch item can be stamped.

Floor space required by the Kensol 110 is 22 by 32 inches. It stands 58 inches high, and weighs 650 pounds. It can be equipped with casters for ease of movement from molding machine to molding machine. Among the various items the unit has stamped are radio cabinet tops, refrigerator trays, and the edges of jewelry boxes.

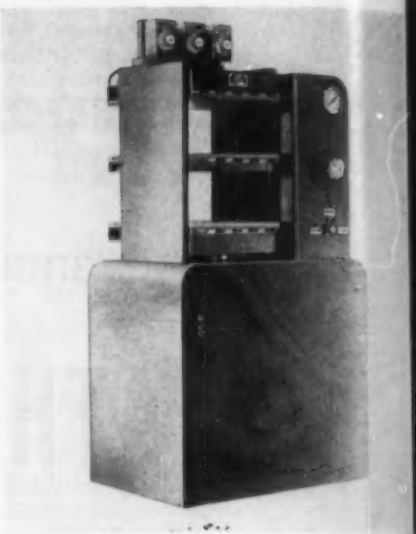


Kensol 110 roll-leaf stamping press.

Readers' Service Item E-2

Two Hydraulic Presses

Two new presses, Models 150-22 and 150-33, have been introduced by Atlas Hydraulics, Inc. Hydraulic pump and oil reservoir are integral parts of the presses, and standard equipment includes electrically-heated, thermostatically-controlled platens; air filter; air regulator; air lubricator; hydraulic pressure gage; and other controls.



Model 150-33 hydraulic press.

Power is taken directly from a regular 100-pound shop air line. Air forces oil out of the reservoir for quick platen closure, and a simple twist diverts the air to the hydraulic boost pump to produce pressures up to 4,500 psi. When preset pressure is reached, the pump comes to rest and operates automatically as required.

Electrically-operated platens afford temperature control to 550° F., and separate thermostats are available for each platen. Heating elements are 230-volt, unless otherwise specified. The two models differ primarily in weight and height; Model 150-22 weighing 1,250 pounds and standing 54 inches high, and Model 150-33 weighing 1,400 pounds and standing 57 inches high.

Both models share the following specifications:

Capacity, tons	75
Platen size, in	14 x 14
Total platen pressure, lbs.	150,000
Distance between platens, in.	6
Ram stroke, in.	6
Ram diameter, in.	6.5
Ram closing speed, in./min.	50
Operating pressure, psi	1,000-4,500
Temperature range, °F	150-550
Floor space required, in.	32 x 18

Readers' Service Item E-3

Vacuum Metallizing Unit

A complete redesign of the vacuum pumping system on its Model 427 72-inch vacuum metallizing unit has been accomplished by the high vacuum equipment division of F. J. Stokes Corp. The restyled system is said to offer faster chamber-evacuation, thus permitting shorter metallizing cycles and greater productivity. Simplification of the pumping system through the use of larger-capacity diffusion pumps eliminates certain vacuum valves and connections, reduces piping, and improves over-all efficiency.

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The new unit has two 16-inch Ring-Jet diffusion pumps, whereas the older model used three 14-inch pumps and still did not achieve the same capacity. The six-inch Ring-Jet booster pump has significantly higher throughput than the booster previously used. As a result, pump-down time time to 0.5 microns (normal flashing pressure) has been reduced to six minutes or less, and the system is better able to handle the heavy outgassing which usually accompanies a vacuum metallizing operation.

Specifications and dimensions are listed as follows:

Chamber diameter, inside, in.	72
Chamber length, in.	60
Vaporation power supply, KVA	15
Height, in.	109
Dept, in.	177
Width, in.	118

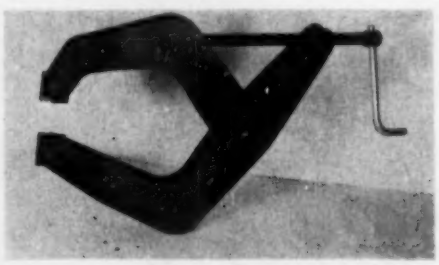
The work holding fixtures on the unit will accomodate 10 reels which are 52 inches long by 14 inches in diameter, or six reels which are 22 inches in diameter and 52 inches long.

Stokes redesigned vacuum metallizing unit.

Readers' Service Item E-4

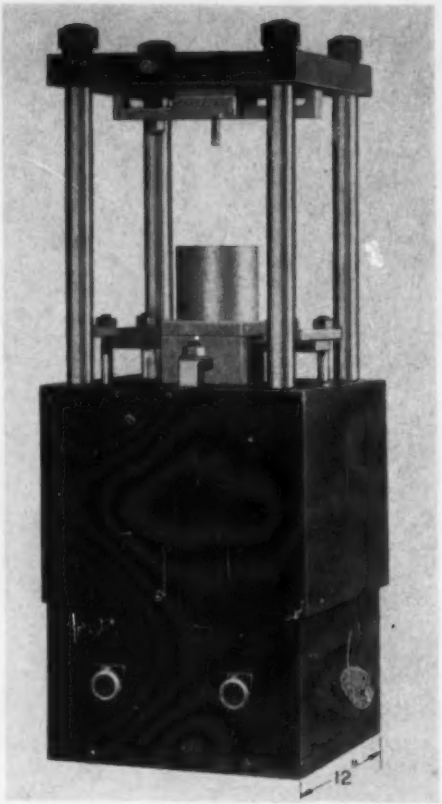
Heavy-Duty Clamping Tool

A deep-throat 10-inch clamp has been added to the Saxton Kant-Twist Clamp line produced by Saxton Mfg. Co. Side plates are wider than those found with other deep-throated clamps, thus making it a high-capacity tool. Deep reach enhances its versatility.



Saxton 10-inch clamp.

Readers' Service Item E-5



Lab press with hydraulic actuating unit.

Hydraulic Actuation Unit

A complete, hydraulic actuation unit consisting of pump, cylinder, pressure switch, reservoir, and motor, has been introduced by Oil-Dyne, Inc. Designed for use with thermosetting compression presses, the unit holds indefinitely under pressure, even with the motor shut off. The pressure switch, an integral part of the hydraulic system, provides automatic shut-off control.

Oil-Dyne originally conceived the unit to operate with a small laboratory press which could be used for small-volume production runs. Here, the pump was a 1/10-hp. unit with 1/4-inch bire cylinder. The average Oil-Dyne pump weighs 7-8 pounds, and will develop and hold pressures up to 5,000 psi. Over-all weight of the lab press was approximately 350 pounds.

Larger units are available, with different numbers, sizes, and types of components. A 1/2-hp. unit with three-inch cylinder can develop forces up to 17 tons, and minimum pressure could be several hundred pounds. In addition to the actuation unit, Oil-Dyne offers valves, switches, and accessories.

Readers' Service Item E-6

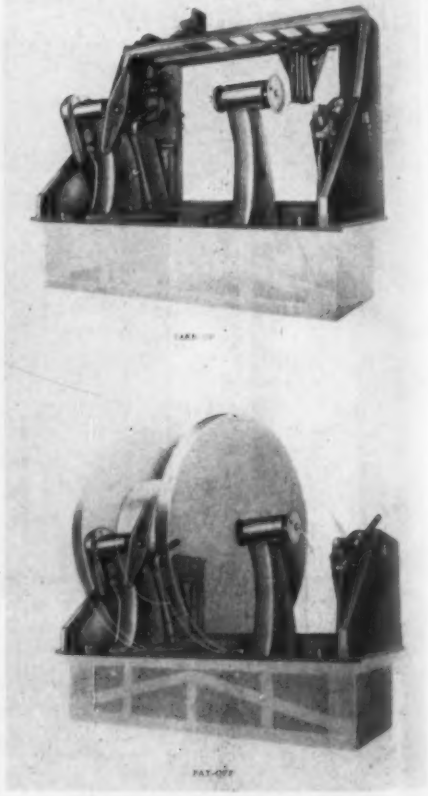
Pay-Off and Take-Up Reels

Two king-size series of reel Pay-Offs and reel Take-Ups for use in the wire industry have been placed on the market by Davis-Standard, a division of Franklin Research Corp. The two 120 Series are designed for reels up to 10 feet in diameter and which weigh up to 30 tons. The two 96 Series will handle reels eight feet in diameter, weighing up to 15 tons.

Reels can be loaded onto either series at floor level, and require neither ramps nor other positioning equipment. Both Pay-Offs and Take-Ups are of the shaftless type, with pintles engaged to the wheel bore by hand-wheels. This obviates the need for moving the heavy reels onto and off of fixed pintles.

The heavy-duty, dual-screw lifts are pushbutton-operated. They lift all reel sizes to a common operating position. Power lowering of reels is braked automatically, and the reels come to a quick stop the instant they touch the floor. Machine construction permits ready access to both the front and the rear of the reel barrel.

The Pay-Offs have variable electromagnetic drags controlled by dial indicators. This enables them to maintain constant torque. Wire tension can be specified. The Take-Ups provide constant tension when reeling from a capstan or haul-off. Both Take-Up sizes have an infinitely variable width of transverse and lay adjustment with a 7:1 ratio. Cable wind can begin at either side of the reel. An over-all 64:1 RPM drive ratio is standard, and the drive is protected down to a complete stall. Complete specification data are available on both machines.

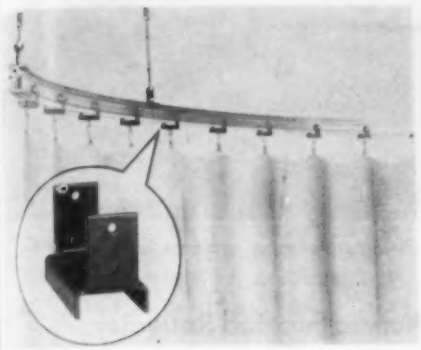


Davis-Standard Take-Up machine.
Davis-Standard Pay-Off machine.

Readers' Service Item E-7

New Products

Write item numbers on Readers' Service Card to obtain more information.



Nylon-coated steel carriers slide noiselessly along an extruded aluminum track.

Nylon-Coated Steel Carriers

Steel curtain-carriers are being nylon coated by Lehigh Research & Development Corp., by the Whirlclad process. This coating process, licensed from Polymer Processes, Inc., utilizes dry powders to obtain engineering results reportedly unobtainable with nylon solutions. Nylon thus adds its wear resistance, low surface friction, and sound-deadening surface characteristics to the strength and dimensional stability of metals.

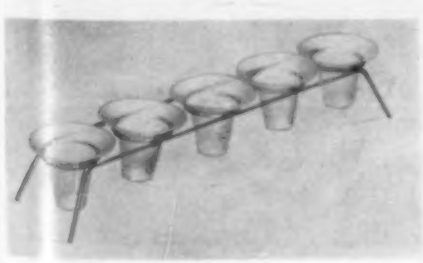
The nylon coating on the curtain carriers prevents metal-to-metal galling and scraping with the aluminum track. By the Whirlclad process, the pre-heated steel carriers are dipped into a bed of finely-divided nylon powder, which are fluidized by ascending currents of gas or air in specialized equipment. The powder sinters and fuses on the surface of the part.

Readers' Service Item P-1

Disposable Vinyl Containers

A new-type blood test kit employing disposable vinyl containers has been developed by Moore & Perk Co. The funnel-shaped containers are pressure formed from non-wetting, calendered vinyl film. Only 10 mils in thickness, their cost is so low that the laboratory technician discards them after one use. This eliminates both the bother and expense of sterilizing glass tubes.

The plastic containers hold 10-15 milliliters. Funnel-shaped, they readily hold the filter papers which are used in the standard laboratory procedure. A five-hole cadmium rack has been designed for use with the vinyl containers.



Blood test kit with disposable vinyl containers.

Readers' Service Item P-2

Vinyl Coated Place Mats

High-style, combed-cotten satins are laminated to the bottom of a rigid vinyl sheet to produce an easy-cleaning, non-slip place mat. H. J. Stotter, Inc., makes the mats from colorful fabrics and Bakelite vinyl sheet. The plastic is easily cleaned with damp cloth, and prevents shrinkage or stretching. The place mats are available in geometric patterns, stripes, and plaids.

Laminated vinyl-fabric place mats.

Readers' Service Item P-3

Vacuum-Formed Air-Scoop Cover

A plastic air-scoop cover for jet planes has been developed for the Columbus Division of North American Aviation, Inc., by Westerville Industries. Inserted in the open nose of the FJ-4 Fury jets, the cover keeps insects, dirt, and other debris out of the jet engine.

PVC air-scoop cover for FJ-4 Fury jet plane.

The covers are vacuum-formed from Seilon, a PVC supplied by Seiberling Rubber Co. The material's high-temperature distortion point and low-temperature impact strength reportedly makes it ideal for this application.

Readers' Service Item P-4

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MFG Corry outboard features one-piece reinforced plastic hull.

Reinforced-Plastic Boat Hull

A series of 12½-foot lapstrake boats featuring a fibrous glass-reinforced polyester hull has been introduced by Molded Fiber Glass Boat Co. Named the MFG Corry, the series includes three mahogany-trimmed models. The hull is molded in one seamless piece, using matched metal dies, and the lapstrake design is integral with the hull.

Other features include a reverse lap between keel and chine, which is said to impart seaworthiness and exceptionally high speed. Maximum beam is 62 inches, and the depth is 25 inches.

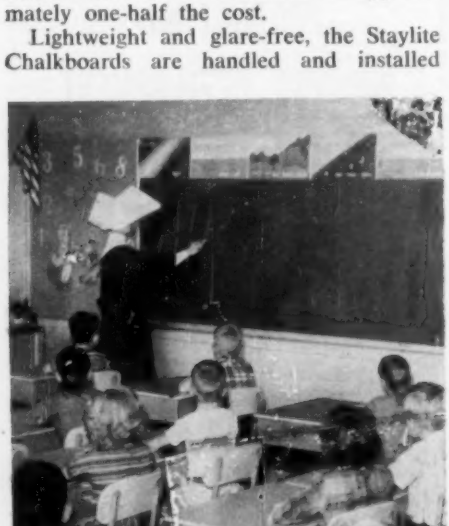
Readers' Service Item P-5

Reinforced Plastic Chalkboard

A new application for reinforced plastic is the Staylite Chalkboard recently introduced by Stahl Industries, Inc. Fabricated from fibrous glass-reinforced polyester resins, the new chalkboards are said to equal or surpass the quality of the best boards now on the market at approximately one-half the cost.

Lightweight and glare-free, the Staylite Chalkboards are handled and installed easily. They can be sawed and drilled on the job with ordinary tools, and require virtually no maintenance. Chalk marks are erased without "ghosting," and laboratory tests have shown the board to withstand well over 50,000 passes of chalk and eraser.

Stahl's boards weigh approximately eight ounces per square foot and are available in four- by eight-foot panels. Colors include light green, grey, white, and dark green; the latter being the most popular due to its glare-free quality and contrast to the white chalk. Polyester resins used in this application are Polylite, a product of Reichhold Chemicals, Inc.



Stylite reinforced plastic chalkboards.

Readers' Service Item P-6

Acrylic Hobbing Material

Ten-inch thick sheets and blocks of a modified copolymer of methyl methacrylate are available from Cadillac Plastic & Chemical Co. Softer, less brittle, and more free-flowing than standard acrylic sheet, the new formulation is reported to be ideal for hobbing or pressure forming of decorative second surfaces.

Pre-production sample of Kenmore washer medallion, hobbed by Sundberg-Ferar, Inc.

The process is similar to that employed in making mold cavities, except that it requires heat as well as pressure. A second matching mold is used to form a contour on the first surface. Brass hobs can be used instead of tool steel and, for very intricate detailing, beryllium bronze has proved very effective.

Hobbed samples have found their best outlets to date among industrial designers, for appearance samples; and among plastics molders, for prototypes. In the latter instance, the molder can check his weights, colors, and decorative problems before bidding on a job. Cadillac's new material is available in clear or colored, 24- by 24-inch sheets with planed surfaces.

Readers' Service Item P-7

Plexiglas reflector operates in 12 directions.

Acrylic Faceted Reflector

A night-time reflector which "lights up" from all directions has been introduced by the reflector division, Dynamic Specialties Corp. Called the Spark-L-Ite, it consists of a hollow three-inch "beehive" molded from transparent acrylic with thousands of tiny facets on the inner surface. The acrylic used is Plexiglas, a product of Rohm & Haas Co.

A row of these reflectors will mark a 90-degree curve, an airfield, parking lot, or a boating area. The molded domes have 36 flat, reflective surfaces which reflect light from 12 directions of the compass and from any reasonable height above the ground. The faceted head is molded in three parts which are joined along vertical seams. The opaque base and cap are available in black, white, or red.

The complete unit is screwed onto the end of a ¼- by 18-inch steel rod which can be inserted into nearly any type of terrain. Ten- and 18-inch extension rods can be obtained. When used for marking boat docks, buoys, buildings, posts, trees, or vehicles Spark-L-Ite is mounted on a simple hardware angle with a ¼-inch machine screw.

Readers' Service Item P-8

Four Laminated Diving Boards

Diving boards with molded-in color and

Eureka plastic laminate diving board.

two-tone finishes are available from S. R. Smith & Co. The four models include: the Eureka, a laminated wood-core totally wrapped with several layers of American Cyanamid's Laminac polyester resin and glass cloth; the Special, standard wood-core wrapped with a single layer of resin and glass cloth; the Fiberkote, standard wood board with one face surfaced with Laminac and glass cloth; and the Glas-Hide, finished on the face only with resin and glass mat.

The old-style diving boards, consisting of a solid wood plank with a uniform wood finish, had to be air-dried for approximately two years before use. The plastic-glass-wood laminates are not only lighter in weight, but are ready for immediate use. They offer greater resiliency, and all feature slip-preventive and permanent waterproof finishes. The series is available in standard or double taper.

Readers' Service Item P-9

Pictar Slide Editor permits ready comparison of 35-mm. slides.

Multi-Slide Viewing Unit

A desk-top slide viewer called the Pictar Slide Editor has been introduced by Mast Development Co. Up to 20 35-mm. slides can be viewed simultaneously, a feature which eliminates the problems usually involved in comparing photos.

The unit measures eight inches high, eight inches deep, and 12 inches wide. It weighs 2½ pounds, and has a 8½- by 10½-inch screen made from Rohm & Haas' translucent Plexiglas acrylic sheet. This screen is formed with a series of narrow shelves to hold the slides or negatives. Bluish-white in color, it provides even diffusion of light from a 40-watt incandescent bulb which assures the maintenance of true color values.

Construction is simple, yet durable. A light, metal box houses the light bulb and holds the 60-mil Plexiglas screen. The latter slides easily up and out of its track.

Readers' Service Item P-10

Topliner television antenna. Inset shows the butyrate insulators.

Butyrate Antenna-Insulators

Technical Appliance Corp.'s Topliner television antenna features outstanding weather resistance thanks to plastics. The firm had Boonton Molding Co. provide them with butyrate insulators, which offer impact resistance, low water absorption, lightness, toughness, and excellent electrical properties. The butyrate used was Tenite, a product of Eastman Chemical Products, Inc.

Topliner antennas are available in a series of models designed to meet conditions in either metropolitan or critical reception areas. All are aluminum with anodized finish. The butyrate parts serve to insulate the mountings where the elements are attached to the crossarm.

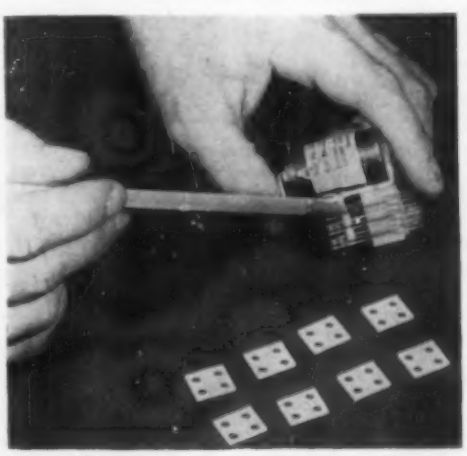
Readers' Service Item P-11

Laminated Relay Spacer Blocks

A heat resistant laminate is being used by Globe Electrical Mfg. Co., for relay spacer blocks which, in turn, increase the operating temperature range of miniature relays. The laminate is Phenolite G-7-830, a glass-base silicone combination produced by National Vulcanized Fibre Co. It resists 500° F., short time, and 400° F. in continuous service.

The laminate's improved (60-66%) heat resistance over conventional paper-base laminates plus its high dielectric strength permit relay operation at proportionally higher temperatures. Hermetic sealing of relays is facilitated by the extremely low volatility of the spacers, and higher vacuums and temperatures can be applied without danger of gassing. Coil ampere turns can be increased, thus offering greater relay sensitivity.

Readers' Service Item P-12



Phenolite laminates used to insulate relays.

Teflon Clipper Seals

Johns-Manville Corp. has introduced Chempac Teflon Clipper Seals, a product which is said to offer positive sealing in the presence of and in contact with solvents and corrosives. Oils with varying aniline points have been contained successfully by the seals, as have such other fluids as rocket engine fuel, perchlorethylene, destructive insecticides, and refrigerants.

Chempac springless and spring-loaded seals.

The seal body is made entirely of Du Pont's Teflon, and is encased in stainless steel or some other corrosion-resistant alloy. A stainless alloy spring actuates the seal lip, and the entire unit is assembled in such a way as to allow maximum sealability with minimum lip wear. Recommended shaft finishes range from 4-8 microinches. The regular seals, spring loaded, are available with diameters of ½-inch up. Springless seals can be obtained with diameters as small as ⅛-inch.

Teflon, a fluorocarbon resin, is well known for its chemical resistance. It is also able to withstand extremes of temperature.

Readers' Service Item P-13

New Literature

Write item numbers on Readers' Service card to obtain copies.

"Butadiene—Its Present and Potential Uses." Petro-Tex Chemical Corp. 42 pages. Complete physical properties, polymerization data, chemical properties, and other detailed information is given on all principal butadiene reactions. Over 286 literature references are cited.

Readers' Service Item L-1

"Teflon Laboratory Ware." No. 581. Bel-Art Products. 4 pages. This catalog describes and lists prices for the firm's line of Teflon tubing, beakers, glass aprons, stirrer blades, stopcock plugs, flasks, and baskets.

Readers' Service Item L-2

"Asbestos-Reinforced Polyester Molding Compounds." Asbestos division, World Commerce Corp. 2 pages. Advantages of Amveco asbestos fibers are listed along with the properties and formulations of a number of reinforced polyester compounds.

Readers' Service Item L-3

"Product of the Times." Luminous Resins, Inc. 8 pages. Plastics that glow in the dark are described and illustrated in this bulletin. These are made by the addition of luminescent pigments to a number of different resins prior to molding. Compounds include Paulite Phosphorescent polystyrenes, polyethylenes, vinyls, acrylic, and acetate.

Readers' Service Item L-4

"Evaluation of Chlorinated Paraffin As a Secondary Plasticizer for PVC." Chlorinated Products division, Diamond Alkali Co. 15 pages. Comprehensive data are listed for two commercial materials, Chlorowax 40 and LV. Test results are illustrated in 11 tables and seven graphs.

Readers' Service Item L-5

"Progress through Research at Air Reduction." Air Reduction Co., Inc. 28 pages. This illustrated booklet describes the research laboratories at Murray Hill, N.J.

Readers' Service Item L-6

"Plaskon Urea, Melamine, Alkyd, and Nylon Molding Compounds." Barrett division, Allied Chemical & Dye Corp. 4 pages. In color, this folder points out new product uses and markets for the above-mentioned compounds. Outstanding properties are given.

Readers' Service Item L-7

"NP-10, Key to Superior Plastisols." TDR #L-101. Eastman Chemical Products, Inc. 8 pages. This brochure summarizes the effectiveness of this polymeric plasticizer in plastisol formulations. Suggested formulations are given for cloth coating, slush molding, foamed plastisols, and clear films.

Readers' Service Item L-8

"New Opportunities in Non-Woven Fabrics." A-5034. E. I. du Pont de Nemours & Co., Inc. 16 pages. Methods of making non-woven fabrics, their properties and characteristics, and their applications are explained along with predictions about their potential markets. Swatches are included.

Readers' Service Item L-9

"Carver Hydraulic Equipment." Bulletin CC-57. Fred S. Garver, Inc. 6 pages. The firm's line of hydraulic filter presses, cocoa presses, hydraulic operating systems, laboratory presses, and laminating presses are described and illustrated in this bulletin.

Readers' Service Item L-10

"1,2,6-Hexanetriol." F-40,066. Union Carbide Chemicals Co. 8 pages. Properties, shipping information, solubilities, performance data, and applications are given for this material. A stable liquid which can be substituted for glycerol in many cases, the compound contains three hydroxyl groups which can be esterified or etherified to form special resins and plasticizers.

Readers' Service Item L-11

"Plexiglas Replacement Glazing for Breakage Resistance in Windows, Skylights, Doors, and Partitions." PL-251: Rohm & Haas Co. 12 pages. Detailed installation instructions, illustrated with cross-sectional drawings, are given along with information on sheet sizes and thicknesses. Plexiglas' properties which are related to glazing, are described in some detail.

Readers' Service Item L-12

"Plexiglas Dome Skylights." PL-301. Rohm & Haas Co. 20 pages. Advantages, basic components, assembly, types, and accessories are described and illustrated. About 10 pages are devoted to the calculation of daylighting values, which should be of considerable value to designers.

Readers' Service Item L-13

"Tote—A Complete System To Solve Your Bulk Material Handling Problems." Catalog 6. Tote System, Inc. 20 pages. Profusely illustrated, the manual describes the system in detail, including automatic filling and discharging stations. Inter- and intra-plant applications of aluminum Tote Bins and Tote Tilts are explained, and specifications are given for construction of the equipment. Special applications are cited, and a list of users and materials handled is included.

Readers' Service Item L-14

"Custom Leak Detection Service." Bulletin 1844. Consolidated Electro-Dynamics Corp. 2 pages. This service utilizes Consolidated Helium Leak Detectors to locate leaks in prototypes of vacuum or pressure equipment. These leaks are then measured and reported.

Readers' Service Item L-15

"Benzol Data File." Benzol Products Co. 29 pages. This folder contains 28 technical bulletins on the firm's chemical intermediates. Price lists are included.

Readers' Service Item L-16

"Bardex—A Sensational New Tubing." Newage Industries, Inc. 1 page. This flyer describes and gives specifications for the reinforced PVC tubing, which can be flexed to an angle of 90° over 1½-million times without cracking or breaking.

Readers' Service Item L-17

"Industrial Equipment Catalog." Precision Equipment Co. 16 pages. Designed to serve as an aid to factory and office planning, this catalog lists and describes standard storage equipment, adjustable steel shelving, revolving bins, materials handling equipment, furniture, cranes, tools, and work benches.

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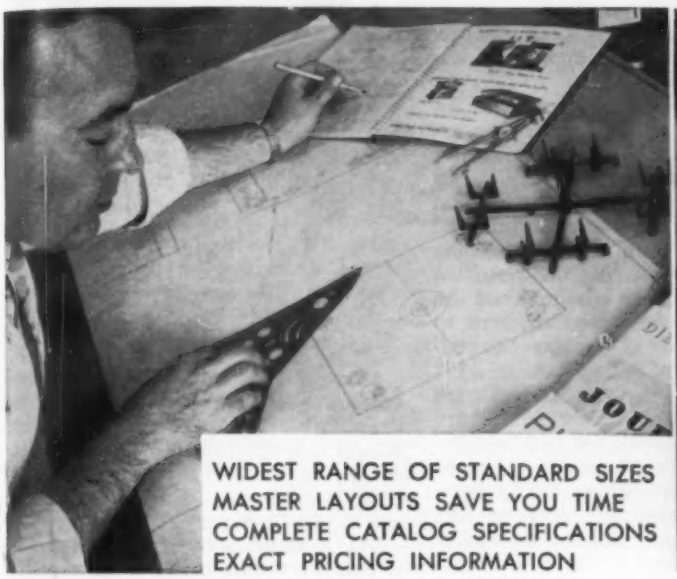

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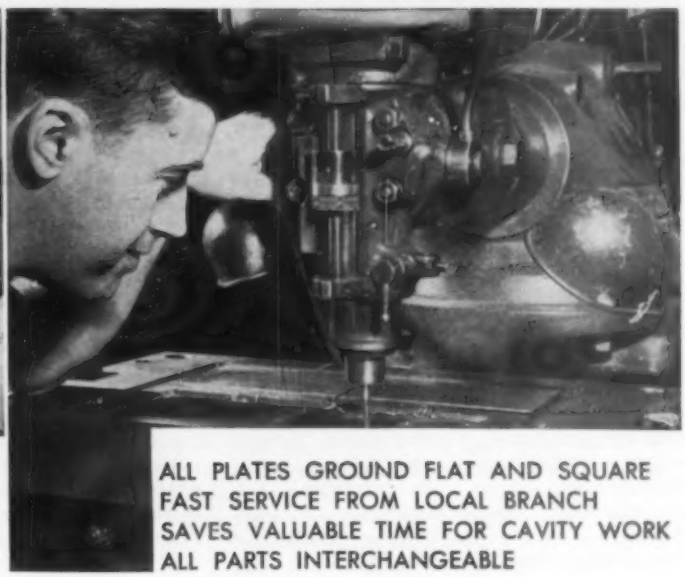

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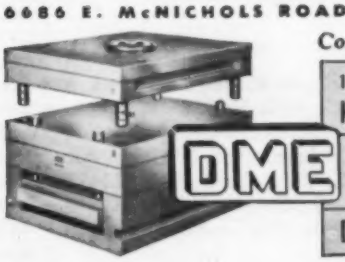

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Book Reviews

"Adhesive for Composite Material Used in Printed Circuitry." Houghton Laboratories, Inc., for Signal Corps, U. S. Army. Order PB 121960 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 83 pages. Price, $2.25.

This work reports the results of a study aimed at the development of improved adhesive systems for composite materials using electrolytic or rolled copper foil. Laminates were produced from paper, nylon, glass, and Orlon by the use of phnoelics, melamine epoxide, silicone, Teflon, and diallyl phthalate resins. The foil-clad laminates were of the XXXP type most frequently used in printed circuitry. Many techniques of surface treatment were explored, and a number of new adhesives with outstanding bond strengths were evaluated.

The best copper-clad laminates were prepared from copper foil, surface-treated with Ebanol Special "C" and bonded with Hysol 2217 adhesive. Bond strength and solder-dip resistance were exceptionally good in nylon-phenolic, melamine-glass, epoxide-glass, and diallyl phthalate-Orlon laminates bonded with the system.

"Chemical Resistance of Plastics." Bureau of Ships, U. S. Navy. Order PB 121133 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 475 pages. Price, $9.00.

Laboratory tests were conducted as to the effects of chemical agents on plastics. Twenty-five materials were tested, representing a broad cross-section of thermosetting and thermoplastic, rigid and flexible materials. The group of 15 chemical agents included dilute mineral acids, concentrated and fuming acids, mercaptans, alcohols, two fuel oils, a hydraulic fluid, peroxides, gasoline, water and an aniline. Behaviors were recorded, as were the effects of prolonged contacts on certain physical properties.

"Connaissance du Moulage par Injection" ("Knowledge of Injection Molding"). Andre Cretin. Published by "Industrie des Plastiques Modernes," 40 rue du Colisee, Paris, France. Stiff paper, about 5¼ by 8 inches, 192 pages.

In a foreword we are told that M. Cretin, the author of this book, is one of the leading designers and builders of injection molding presses in France, and that a French firm is now building machines under licenses from him.

The present work is a collection of his notes on injection molding that have appeared in the French plastics magazine, "Industrie des Plastiques Modernes." They are divided into two main parts: the first is devoted to an "Experimental Study of Injection"; low-pressure injection molding with multi-cavity molds and non-restricted gating; the principles of injection; and the major difficulties encountered and how to combat them. Part II, on the "Experimental Study of Molds," opens with a list of points which a designer of injection molds must take into consideration. Then, the selection of materials for molds is discussed, followed by comments on mold cores, ejectors, operating mechanisms, vents, etc. A number of diagrams and illustrations, and an alphabetical index add to the usefulness of the little book. (In French.)

"Materials on Review." Prepared by the editors of Packaging Parade. Haywood Publishing Co., 6 North Michigan Ave., Chicago, Ill. Paper 8½ by 11 inches, 52 pages. Price, $3.50.

This work appeared originally in consecutive installments in Packaging Parade magazine. It describes every basic product used in packaging from paper, the oldest, to the new polyvinyl alcohol films which dissolve in water. Eighteen different materials are examined for their advantages and limitations in packaging, their printing and sealing characteristics, and their physical and chemical properties.

Separate chapters are devoted to each plastic packaging material: cellulose acetate, Mylar, polyethylene, pliofilm, polystyrene, saran, vinyl, and the aforementioned polyvinyl alcohol. Over 100 illustrations are included, and a list of trade names and manufacturers appears at the end of each chapter.

"An Approach to the Synthesis of a Polyamide Plastic with Hydrophilic Properties." E. L. Totton, North Carolina College at Durham, for Wright Air Development Center. Order PB 121473 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 16 pages. Price, 50c.

This work reports an apparently successful approach to the synthesis of tetra-O-methyl-D-glucaric acid. The author utilized the lactone of D-glucaric acid for the preparation of the di-p-toluidide of D-glucaric acid, the di-p-hydroxyanilide of D-glucaric acid, the tetra-O-acetyl-di-p-toluidide of D-glucaric acid, and the hexa-O-acetyl-di-p-hydroxyanilide of D-glucaric acid.

Methylation of tetra-O-acetyl-di-p-toluide of D-glucaric acid resulted in a water-soluble syrup. This product was treated with sodium hydroxide in ethylene glycol, and a salt was isolated. The salt then was acidified with hydrochloric acid and a water-soluble syrup was produced which was thought to be tetra-O-methyl-D-glucaric acid. Its water solubility indicated that it might produce a polymer with hydrophilic properties.

"Expanded Resin Cuffs for Modifying Inboard Sections of High Speed Model Propeller Test Blades." G. T. Wright, Wright Air Development Center, for U. S. Air Force. Order PB 121884 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 22 pages, Price 75c.

The application of expanded resin cuffs to model propeller blades is an inexpensive method of altering the aerodynamic characteristics of restricted sections. A commercial, foam-in-plase isocyanate resin was used as the cuff material. A unique characteristic of the resin was the formation of a high-density layer on the outer surface of the low-density mass. One-quarter inch thick, this layer was distinguished by a smaller, more compact cell structure.

The above-mentioned layer improved erosion resistance of the cuff. The method of application alleviated such difficulties as inconsistent density, irregular cell size, voids, improper preheat and postcure, and inconsistencies in the resin-to-metal bond.

"Symposium on Radiation Effects on Materials." American Society of Testing Materials, 1916 Race St., Philadelphia 3, Pa. Hard Cover 6 by 9 inches, 196 pages. Price, $4.75.

This symposium was the first in series which will be sponsored jointly by ASTM Committee E-10 on Radioisotopes and Radiation Effects and the Atomic Industrial Forum. It was presented at the ASTM second Pacific-Area meeting, which was held in Los Angeles, Calif., in September, 1956. Main topics covered were Theory of Radiation; Radiation Facilities and Mechanics of Testing; and Experimental Tests and Results on Fuel, Graphite Materials, and Structural Materials. Sixteen papers were presented. The data and evaluations should contribute to the understanding of existing code and specification values as they apply to nuclear reactor structures and components.

Abstracts of Important Articles

Materials

"Creep of Glass-Reinforced Plastics," S. Goldfein, *ASTM Bull.*, No. 225, 29 (Oct. 1957).

This is an interim report of the development of a method for determining the creep properties of glass-reinforced laminates by short-time or static tests of their properties at temperatures up to 500° F. Tables of extensive test data are included.

"A Study of the Low-Temperature Brittleness Testing of Polyethylene," E. A. W. Hoff and S. Turner, *ASTM Bull.*, No. 225, 58 (Oct. 1957).

Low-temperature brittleness tests do not give unique values for polyethylene, but depend markedly on specimen preparation. If brittleness test results are to be meaningful and reproducible, a more stringent specification covering specimen preparation and conditioning is needed.

"Synthetic Fiber Reinforced Thermosetting Resins," J. G. Green, Jr., and G. W. Mays, *SPE J.*, 13, 9, 24 (Sept. 1957).

Results are given of an investigation made of reinforced plastics made with nylon, Dacron, and Orlon synthetic fibers as reinforcements. It is shown that each of these fibers can improve the usefulness of the resultant reinforced plastic by providing significant product improvements in electrical, chemical, mechanical, and esthetic properties.

"Extreme Strength Reinforced Plastic Films," Johan Bjorksten, *SPE J.*, 13, 9, 27 (Sept. 1957).

A condensation of an SPE 1957 Conference paper, this report describes extreme strength reinforced plastic film systems that have been developed. These are plastic films reinforced with slightly twisted Dacron or nylon yarn.

"Effect of Lay-Up Configuration on Flexural Properties of 181 Glass Cloth Laminates," W. R. McGlone, *SPE J.*, 13, 10, 30 (Oct. 1957).

The effect of fiber location on the flexural properties of two different types of four-ply lay-ups is discussed, and it is shown how the flexural strength and elastic modulus in bending vary with the resin content. An estimate is given of the strength of the laminate based on the strengths of the glass and resin and their orientation and position in the laminate. The disappearance of fiber orientation effects with increasing number of cloth plies is mentioned.

"Plastics Sandwich Construction," G. D. Miller and H. J. Waite, *SPE J.*, 13, 10, 27 (Oct. 1957).

This condensation of an SPE 1957 Conference paper briefly discusses the great variety of materials that can be used for plastics sandwich constructions, and the fields of application of these sandwiches in aircraft, architecture, heat insulation, and fire resistance uses.

"Determination of the Flow Properties of Thermoplastic Melts," J. M. McKelvey, J. Gavis, and T. G. Smith, *SPE J.*, 13, 9, 29 (Sept. 1957).

A review of methods and instruments for measuring the flow properties of extremely viscous fluids, with particular reference to the problems peculiar to thermoplastic melts.

"The Vicat Softening Point Test for Plastics," C. E. Stephenson and A. H. Wilbourn, *ASTM Bull.*, No. 224, 32 (Sept. 1957).

Description of an indentation-type softening point test carried out under conditions of uniformly rising temperature that has been adopted by the British Standards Institution. The test is a development from the Vicat-needle test for characterizing the form-stability of rigid electrical insulating materials. The apparatus is of the same basic design as that devised by Vicat in the late nineteenth century for determining the setting time of cement. Results obtained in tests with polyethylene, polymethylene, and nylon 6 are given.

"Controlled Thermal-Shock Loading of Glass-Cloth Laminates," J. H. Beno, A. M. Dowell, and E. F. Smith, *ASTM Bull.*, No. 225, 25 (Oct. 1957).

A method capable of simulating aerodynamic heating is described that makes use of a molten-metal bath as the heating medium, and is more convenient and controllable than other methods for thermal shock load testing. The equipment used in the study also has been employed to investigate the mechanism by which laminates fail when subjected to severe thermal shock.

"Relationships between Electrical and Mechanical Properties of Epoxy Plastics," John Delmonte, *ASTM Bull.*, No. 224, 32 (Sept. 1957).

The resilient epoxy resins will depict significant electrical and mechanical property changes upon long-time aging at elevated temperatures. It may be possible to use non-destructive dielectric measurements for tracing changes in epoxy resin compounds.

"Long-Term Rupture and Impact Stresses in Reinforced Plastics," Solomon Goldfein, *ASTM Bull.*, No. 224, 36 (Sept. 1957).

A new method is described for evaluating strength data as a function of time and temperature. The procedure involves determination of rupture properties at various temperatures by standard test methods, and a mathematical and graphical relationship to determine rupture properties for extremely short and long periods of time.

"Irradiated Polyethylene Film," A Charlesby and T. Bain, *Brit. Plastics*, 30, 4, 146 (April 1957).

Irradiated polyethylene is now available in pilot-plant quantities in Britain. How and why it can be used for various electrical applications, as well as for packaging and other purposes, are discussed.

"Determination of the Reactivity of Xylenol Compounds by Measuring Turbidity and Heat of Reaction," M. Krahl, *Kunststoffe*, 47, 7 375 (July 1957).

Investigations of phenols contaminated by xylenols from various sources led to the development of new, rapid procedures for determining turbidity time and heat of reaction to evaluate xylenols. The methods can be varied and dispense with photometers. (In German.)

"Dephenolation and Utilization of Waste Water from the Production of Phenol-formaldehyde Resins," R. Hessen, *Plaste u. Kautschuk*, 4, 2, 51 (Feb. 1957).

Description of an alkali condensation process and apparatus for dephenolating waste water resulting from production of phenol-formaldehyde resins and rendering the water fit for reuse. The resin precipitated in the process is a pure resol having a molecular weight about 1,700 and containing no free phenol. This acts as an accelerator for slow-curing resins to which it is added. (In German.)

Equipment

"Mold Making by Electroforming," S. Fialkoff, *SPE J.*, 13, 9, 41 (Spet. 1957).

A brief discussion of the electroforming process for making molds that cannot be made readily by conventional mold making methods.

"Maintenance of Electrical Equipment," F. R. Cinco, *SPE J.*, 13, 10, 39 (Oct. 1957).

A generalized discussion of the operations in a preventive maintenance program.

"Treatment of Mold Design Problems," Gordon Thayer, *SPE J.*, 13, 10, 48 (Oct. 1957).

Solutions are suggested to some problems in mold design, including double draw molds, self-trimming molds, and double-acting ejector molds.

"Elimination of Extruder Screw Galling," H. S. Gonser, *Plastics World*, 15, 10, 7 (Oct. 1957).

Successful solution of the galling problem with an extruder screw needing acid resistance plus strength was achieved by use of a hard-faced nickel alloy screw that runs in a nickel alloy liner. Screw flights are protected with a welded overlay of Colmonoy No. 6, a nickel-base material containing chromium borides.

"New Knowledge on Extrusion with High Speed Screws," E. Beck, *Kunststoffe*, 47, 5, 250 (May 1957).

In connection with the further development of high-speed, single-screw extruders with automatic controls, the theory of which was discussed in earlier issues of this German periodical, numerous tests were performed. Machines with screw diameter of 18 and 35 millimeters already are being operated on a commercial scale. The results described in the present report give an idea of the field of application for machines with screw diameters up to 65 millimeters. (In German.)

Processing

"Some Aspects of the Shaping of Acrylic and PVC Rigid Sheet," J. M. J. Estevez and D. C. Powell, *Plastics Inst. Trans.*, 25, 60, 80 (April 1957).

Some fundamental aspects of shaping polymethacrylic and rigid PVC sheet, and their relation to problems of the industry, are considered. Included are advantages and limitations of different types of ovens; the role of temperature; conditions for applying such shaping techniques as blowing, plunger and ring methoding and vacuum-assisted pressing; the making of advertising signs and facia boards; production of globe-type lighting fittings; and decoration.

"Extrusion Problems," S. W. Trill, *Plastics Inst. Trans.*, 25, 60, 137 (April 1957).

Only the extrusion of thermoplastic cable coverings is considered. An introductory sketch of the history of extrusion development and a brief mention of modern cable extrusion plants are followed by a discussion of the behavior of PVC and polyethylene. The problems treated relate to controlled cooling for polyethylene, control of cable or core diameter, and efficiency of the extrusion machine drive.

"Automation in the Processing of Plastics," C. M. Dolezalek, *Kunststoffe*, 47, 8, 412 (Aug. 1957).

Presented before the 7th German Plastics Conference, this paper deals with the factors to be considered in automatic molding of compounds in presses, injection machines, and extruders. Some instances are given of how automation can be introduced in the processing of thermoplastics and thermoset materials. (In German.)

"Welding and Bonding of Acrylic Glass," F. Esser, *Kunststoffe*, 47, 8, 516 (Aug. 1957).

The various methods for bonding acrylic glass to itself or to other materials include hot air welding, high-frequency or friction welding, and the use of solvents alone, adhesive varnishes, and special polymeric adhesives. The merits of the different systems for specific purposes are explained in this paper presented at the 7th German Plastics Conference. (In German.)

"Transfer Molding of Hardenable Plastics," H. Spies, *Plastverarbeiter*, 8, 3, 100 (March 1957).

The advantages and disadvantages of transfer molding are mentioned briefly, then the types of material and how they should be processed are considered. Construction details of suitable equipment are described. (In German.)

"Low Voltage Induction Heating of Injection Molding Machines," C. K. Marklew, *Brit. Plastics*, 30, 5, 190 (May 1957).

The limitations of existing systems of providing heat for heating cylinders on injection molding machines are mentioned and a low-voltage induction system is described which removes these limitations. It is claimed that several of these new units have been running continuously for some time now at 720° F.; coil life is said to be indefinitely long; heating time is shorter and power consumption is lower than with resistance heating; inaccuracies of band fitting are eliminated; plasticizing capacity is largely increased; and cylinder temperature is controlled easily.

Applications

"Recent Developments in the Use of Laminates for Printed Circuits," D. Lidgley, *Plastics Inst. Trans.*, 24, 58, 326 (Oct. 1956).

Only copper-clad, paper based phenolic laminates for printed circuits are dealt with in this survey. The design of printed circuits and their preparation by the Technograph and photographic printing processes are described, and the electrical and mechanical properties of the copper-clad laminates are discussed.

"The Role of Adhesives in Industry," S. R. Badley, *Plastics Inst. Trans.*, 24, 58, 337 (Oct. 1957).

The application of animal and casein glues, as well as vegetable, rubber, and synthetic adhesives in woodworking, plywood, furniture, airplanes, paper and carton-sealing, among others, is described. It is noted that despite competition from newer materials, the technical improvement of the traditional glues has enabled them to hold their own and, for certain applications, be the best.

"The Fabrication and Application of Epoxy Resins," J. O. W. van Dugteren, *Plastica*, 10, 4, 222 (April 1957).

General article on the methods of employing epoxy resins for various purposes, in the repair of mud guards for automobiles, in the aviation industry in the United States, and in the chemical industry in England. Epoxy resins are compared with polyester resins, and some of the economic aspects of their use are considered. (In Dutch.)

"Standards for Plastics in Electrical and Electronic Equipment," L. E. Sieffert and J. B. Alfers, *Western Plastics*, 4, 9, 26 (Sept. 1957).

This is essentially a summary report on testing work done by the Navy's Bureau of Ships in the preparation of military specifications on plastics.

"New Developments in Ureaformaldehyde Foams," H. Baumann, *Kunstoffe*, 47, 5, 256 (May 1957).

The fields of application for ureaformaldehyde foam have been expanded greatly through the development of small, portable foaming units for producing foams in situ. This enables them to be introduced directly into the objects which are to be insulated. The author reviews applications in mining, power stations, and in the building industry. (In German).

"The Application of Plastic Piping," H. Dahlmann, *Kunstoff-Rundschau,* 4, 1, 9 (Jan. 1957).

The use of plastic pipe in West Germany has increased from a few thousand meters during 1953, to some hundreds of kilometers a month. The various applications of rigid PVC and polyethylene pipe, as well as the fittings employed, are discussed together with frequent references to DIN standards. A table which gives dimensions and weights of the polyethylene pipe used in Germany is included. (In German).

"Where to Use Polyester Film," M. W. Riley, *Materials & Design Eng.,* 46, 3, 104 (Sept. 1957).

A guide to the electrical, mechanical, and decorative uses of the plastic material.

"Sandwich Panels for Building," E. Ercoli, *Materie Plastiche,* 23, 2, 92 (Feb. 1957).

The types of sandwich panels of Italian and foreign make used for various purposes in buildings are discussed, with emphasis on economical considerations. Tables are presented giving data on properties and compositions of materials for panel cores and faces and adhesives, as well as of some of the sandwich materials commonly employed. (In Italian.)

"Plastics for the Armed Services," Kiger, *Ind. Plastiques Mod.* 9, 5, 14 (May 1957).

Review of the use of plastics for packaging and distribution of food supplies, and in clothing and equipment for the French military services, with special reference to helmets and bullet-proof vests. The latter differ substantially from the American types. (In French.)

"Gabbropolyester Resins in Anatomical Studies," C. Dainelli, *Materie Plastiche,* 23, 2, 114 (Feb. 1957).

Gabbropolyester PIN, produced by Montecatini, is a low-viscosity resin with good penetrating powers. It can be colored suitably, and serves for making anatomical models, as explained by the example of the renal plexus. (In Italian.)

"Some Applications of Plastics in Chemical Plant," G. Pastonesi, *Materie Plastiche,* 23, 2, 131 (Feb. 1957).

Plastics are increasingly replacing monel and Hastalloy type metals, ceramics and rubber in tubing and linings for chemical plant. The use, especially of PVC, but also of Teflon and phenolics in ventilators, washing plant, Guy Lussac towers, pumps, filters, tubing etc., is described, reference being made to American, German and Italian practice. (In Italian.)

"Evaluation of Reinforced Plastic Pipe," B. Kellam; *Canadian Plastics,* (March 1957), "Non-destructive Testing of Plastic Pipe," R. D. Brown (April 1957,) and "Physical Tests on Reinforced Plastics Pipe," J. C. Platt," (April 1957).

This series of articles describes environmental, non-destructive, and physical tests carried out to determine the extent to which selected plastics answer the requirements of reinforced plastic pipe to replace steel pipe for high voltage cable underground. Results indicate large variations in chemical behavior of each resin tested; the polyesters showed insufficient resistance to normal ground waters, but some epoxies appear promising. The need is seen for greater control over variables involved (the resin is a major variable), and for reliable test methods for evaluating pipe for various applications. It also appeared that each application of plastic pipe must be regarded as a separate problem.

"Plastic Films and Laminates in Agriculture," A. Trevisan, Poliplasti, 5, 19, 18 (Jan.-Feb., 1957).

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Review of the uses of films and laminates for greenhouses and various types of protective covers mainly in experiments in the United States. Details also are given of the properties and uses of an Italian polyester-fiber glass laminate in agriculture. (In Italian.)

"Lighting Fittings of Organic Glass," W. Bauer, *Kunststoffe*, 47, 6, 334 (June 1957).

The special light-transmitting properties of acrylic glass are utilized to produce novel indirect lighting fixtures for interiors. Strips of the acrylic, which may be colored, are curved and arranged to form a variety of decorative designs. The new way of using acrylic glass also may prove adaptable for industrial purposes and vehicle illuminations. (In German.)

"PVC Pipe Lines with Screw Joints," H. Jungnickel, *Kunststoffe*, 47, 6, 333 (June 1957).

While screw joints for PVC pipe lines have been rejected in Germany and other European countries, they have been accepted in the Union of South Africa where they have been in satisfactory service for about 15 months. The circumstances favoring the employment of these joints in South Africa and experiences to date are reported. (In German.)

"Plastic Toys Make Headway," K. Brockhaus, *Plastverarbeiter* 8, 2, 41 (Feb. 1957).

General discussion of the German toy manufacturing industry and business; in particular, the history of use of the various plastics for toys, and the role plastics now play in this field. Numerous illustrations of plastic toys by different German manufacturers are included. (In German.)

"Non-Reinforced Polyester Resins," E. Behnke, *Gummi u. Asbestos*, 10, 4, 209 (April 1957). The properties of glass-reinforced and non-reinforced polyester resins are compared and the use of the latter as pure resin, as well as colored and loaded materials for various purposes are discussed, including insulation of electrical systems, the making of anatomical castings and special molds and uses in floorings and as adhesives. Shrinkage and electrical properties of certain types of resins are tabulated, together with the effects of a number of hardeners on the electrical properties of a standard resin. (In German.)

"Structure and Properties of Polyethylene as Electrical Insulating Material," L. Nicolas, *Ind. Plastiques Mod.*, 9, 7, 43 (July-Aug. 1957).

The synthesis and molecular structure of high- and low-pressure polyethylene are reviewed, and the properties which affect their behaviour and use as electrical insulating materials. It is shown that the dielectric properties of polyethylene may depend on functional groups accidentally introduced as impurities in the methylene chain, but do not depend on the molecular structure of the body. Hence, the electrical properties of the new polyethylenes do not differ markedly from those of the older types, but the important changes in physical and mechanical properties resulting from their different structure make them of interest to manufacturers of insulating materials, as well as to manufacturers of other articles. (In French.)

General

"Trademark Abuses and Relief," Gustav Drews, *SPE J.*, 13, 9, 43 (Sept. 1957).

Description of abuses to be guarded against in the use and preparation of trademarks.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. The publishers and their addresses are given below:

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"Revista de Plasticos"
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"Revue Générale des Matiéres Plastiques"
196 Ave. Jean-Jaures, Paris 19e, France

"Rubber and Plastics Age"
Rubber and Technical Press, Ltd.
Tenterden, Kent, England

"SPE Journal"
Security Bank Bldg., Athens, Ohio

"Transactions of the Plastics Institute"
9 Mandeville Place, London W. 1, England

Patent Digest

Materials

Stabilization of Unsaturated Nitriles. No. 2,784,219. Louis J. Couvillon, Texas City, Tex. (to Monsanto Chemical Co., St. Louis, Mo.).

A composition comprising an unsaturated nitrile containing a minor amount of a metal salt of N,N-dialkyldithiocarbamic acid, wherein each of the alkyl groups contains from 1-8 carbon atoms.

Perfluorochloroolefin Polymers Plasticized With Perfluorochloroolefin Copolymers. No. 2,789,960. Richard A. Smith, Cornwall on the Hudson, N. Y. (to M. W. Kellog Co., Jersey City, N. J.)

A perfluorochloroethylene copolymer is admixed with another containing a lesser mole percentage of perfluorochloroethylene. Both copolymers contain at least one halogen substituent.

Stabilized Vinyl Chloride Compositions. No. 2,789,100. Joseph E. Wilson, New Brunswick, N. J. (to Union Carbide Corp., N.Y.)

A composition comprising a polyvinyl chloride resin, a plasticizer, dibutyl tin dilaurate, and from 0.5-10% by weight of ethyl ortho-silicate resin.

Production of Molded Articles From Mixed Synthetic Substances. No. 2,788,545. Walter Bauer, Darmstadt, Germany.

A copolymer of vinyl chloride and vinyl acetate is mixed with a monomeric component consisting of at least one lower ester of acrylic and methacrylic acid to form a moldable, homogeneous plastic mass which is stable under normal temperatures.

Mixtures of a Hard Styrene Polymer and a Copolymer of Butadiene With Fumaric Acid Di-n-Butyl Ester and Shaped Articles Made From Such Mixtures. No. 2,789,961. Friedrich Hoelscher, Otterstadt, Pfalz, Germany. (to Badische Anilin- & Soda Fabrik Aktiengesellschaft, Ludwigshafen, Germany.).

Shaped articles of high impact strength are made from a plastics mixture consisting of 70-95% by weight of a hard styrene polymer, and from 30-5% by weight of a copolymer of fumaric acid di-normal-butyl ester and butadiene.

Non-Gelling Polyamide Solutions. No. 2,788,287. Samuel Zweig, Chicago, Ill. (to Borden Co., New York, N. Y.).

A solution that exhibits non-gelling characteristics at ordinary temperatures consisting of an alkylene diamine polyamide of polymeric fat acids; an isopropyl or butyl alcohol, or mixture thereof; and from 0.1-6% of water based on the total weight of the solution.

Foamed Diisocyanate Modified Polyesters of Very Low Specific Gravity. No. 2,788,332. Erwin Mueller, Leverkusen-Bayerwerk, and Peter Hoppe, Troisdorf, Germany. (to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany.).

A polyester condensation product of a polyhydric alcohol; a polyhydric alcohol; and a polybasic carboxylic acid are reacted with water to form a foamed plastic of very low specific gravity.

Cellular Reaction Products of Castor Oil, An Epoxy Resin, and an Aromatic Diisocyanate. No. 2,788,335. Eric Bartel, New Castle Del. (to E. I. du Pont de Nemours and Co.).

While protected from atmospheric moisture, an epoxy resin-castor oil condensation product containing from 0.025-0.5 mol of epoxy resin per mol of castor oil is reacted with an arylene diisocyanate in a proportion ranging from 1.2-1.9 mols per hydroxyl group to produce a cellular plastic material.

Linear Polyamide Polymers of 4-Amino-Cyclohexyl-Acetic Acid. No. 2,790,788. Jonas Kamlet, Easton, Conn. (to National Distillers Products Corp., New York, N. Y.).

A monomer consisting of the mixed stereoisomers of cis-trans-4-aminocyclohexyl acetic acid and the ethyl esters thereof are heated to a temperature of 150-400° C., to obtain a polymer which will not melt below 400° C.

Equipment

Heat Sealing Thermoplastic Polymers. No. 2,785,729. Richard A. Smith, Cornwall-on-the-Hudson, N. Y., and Fred W. West, Ridgefield, N. J. (to M. W. Kellogg Co., Jersey City, N. J.).

A device for heat sealing thermoplastic polymers comprises a heat-conductive, elongated, body member of rectangular cross-section; a means for heating and controlling the temperature of the body member; and elongated insulating members, so adapted as to form a confined, heat-conductive surface between them.

Injection Molding Machine With Stress Control System. No. 2,790,204. Evan A. Edwards and Lawrence A. Ulmschneider, Rochester, N. Y. (to Eastman Kodak Co., Rochester, N. Y.)

In an injection molding machine, a plurality of tie rods connect fixed and adjustable platens, and slidably support a movable platen. A longitudinal aperture in at least one of the tie rods receives a tension rod that is held in position by spring pressure. An arm attached to the free end of the tie rod is arranged through appropriate linkage to actuate a stress indicating gage and a microswitch, which in turn opens the molding machine when the stress on the tie rod has exceeded a predetermined amount. A toggle attached to the adjustable and movable platens actuates another microswitch to open the electrical circuit when the mold

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is completely closed to permit a pressure to be exerted in excess of that which otherwise would cause the mold to open.

Apparatus for Applying a Coating to Sheet Material. No. 2,788,051. Orvil S. Tuttle, Pacific Palisades, Calif. (to Honeycomb Structures Co., Inc. Los Angeles, Calif.)

A closed tubular body is rotatably and permanently affixed to a pair of coaligned bearings mounted in fixed supporting members. The tube is provided with a heating means; an elongated extrusion slot; and communicates, through a conduit, with a supply source of thermosetting coating material. The slot is rotatable to a fixed position whereby it can extrude the coating onto a sheet at a fixed angle of incidence and at a rate equal to the rate of travel of the sheet material. The slot can be adjusted to an upward, non-operative position, to prevent gravitational flow of the coating substance.

Plastic Bottle Molding Machine. No. 2,789,313. Edward R. Knowles, Elizabeth, N. J. (to Lapin Products Inc., Newark, N. J.)

The injection molding machine for plastic bottles includes: a two-piece mold, forming the body of the bottle; a core pin having a central axial passageway and an upper portion designed with a peripheral ridged head and a plurality of radial passageways to receive compressed air; an outlet opening at the bottom of the core pin provided with a reciprocating conical valve that is controlled by a valve rod extending through the passageway; reciprocating means to move the valve assembly; and a withdrawable, cylindrical shell pin, inserted within the cavity and positioned concentrically around the core pin to provide an annular recess which is initially filled with plastic. The shell pin is withdrawn to permit the plastic to be expanded to the shape of the cavity.

Machinery for Molding and Cutting Out Pieces of Plastic Material From a Web. No. 2,790,399. Willi Mayer, Kandern, Baden, Germany.

A machine for cutting out shaped articles from an intermittently travelling web of plastic material comprises a machine frame; a reciprocating cutter shell; an inner bottom; an abutment for the cutter; a stripping means surrounding the cutter shell; a slidable clamping means for the shaped article; and an ejector for removing the shaped article and scrap web from the cutting zone.

Pre-Plasticizing Unit for Use With a Plastic Molding Machine. No. 2,790,203. Robert H. Dykehouse, Monterey Park, Calif.

The unit incorporates a reservoir to hold particulate plastic solids; plus a feed passage through which the solids are transmitted to a plasticizing passage, spirally disposed about the injection chamber of the molding machine. The feed passage is provided with a means for moving the material along the plasticizing passage to the injection chamber. A heating means is provided between the plasticizing passage and the injection chamber in such a manner as to supply the greatest quantity of heat at the inlet, in order to minimize operating pressures within the passage.

Processing

Molding Method. No. 2,790,998. Charles L. Dimmer, Toledo, O. (to Toledo Dental Products Co., Toledo, O.)

A method for preparing a small molding in an investment mold comprises: heating a thermoplastic synthetic resinous extrusion slug to an incipient plastic state; injecting this material into the mold; and maintaining a pressure from 2000-8000 pounds per square inch on it for at least five seconds after injection is completed. The orifice through which the material is injected has a maximum cross-sectional area not greater than 0.15 square inch, while the mold itself, has an opening to atmosphere not greater than 0.075 square inch. Injection rate for the composition ranges from 0.3-0.6 cubic inch per second.

Process of Insulating Wire With Polytetrafluoroethylene. No. 2,789,926. Robert W. Finholt, Erie, and William J. Wunch, Wesleyville, Pa. (to General Electric Co,, Schenectady, N. Y.)

Tetrafluoroethylene polymer and polished wire are brought into intimate contact while in transit through grooved calender rollers. Leaving the rollers, the coated wire is heated to a temperature above 327° C., to fuse the polymer into a tough flexible coating.

Production of Porous Shaped Articles from Thermoplastic Substances. No. 2,787,809. Fritz Stastny, Weinheim, Germany. (to Badische Anilin- & Soda-Fabrik A. G., Ludwigshafen, Germany).

Small particles of a porous and partially, but incompletely, foamed-up synthetic thermoplastic material is subjected to heat in a closed mold which permits the escape of gases, but retains the material to form a porous, shaped article.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

—The Editor

Process for Producing Porous Polytetrafluoroethylene Film. No. 2,790,999 David B. Peck, Williamstown, Ralph A. Hammann, North Adams, and Hugh W. Kirkpatrick, Williamstown, Mass. (to Sprague Electric Co., North Adams, Mass.)

A tension of four pounds per linear inch of width is applied to a 2½-mill thick solid polytetrafluoroethylene resin film. At the same time a pressure of approximately 8000 psi. is applied in the plane normal to the film to reduce its thickness to about 1.2 mils. The process is carried out at an ambient film temperature below 70° C., and the resulting product has a porosity of about 15%.

Method of Making Polytetrafluoroethylene Articles. No. 2,786,792. William F. Mikiska, St. Paul, Minn. (to Minnesota Mining & Manufacturing Co., St. Paul, Minn.).

Layers of soft, unsintered, lubricant-free, polytetrafluoroethylene film are assembled in stack form. Thin layers of metal are inserted between each two adjoining layers of the film, in contact with all areas which are designed to be free surfaces of the envelope. The stack is sintered causing the contacting areas of the film to cohere and bond together. After the stack is cooled, the envelope is opened and expanded.

Method of Making an Extensible Flexible Hose Assembly. No. 2,784,819. Jack E. Duff, Canton, O. (to Hoover Co., North Canton, O.).

A thermoplastic tube is placed over a spiral, cylindrical, reinforcing element. The assembly is heated until the tube is in a semi-plastic condition, at which time a suction is applied to the interior to draw the wall of the tube between the turns of the element.

Method of Making Flocked Fabric and Flocked Vinyl Film. No. 2,784,630. Longine Koprow, Dumont, N. J., and Walter R. Saks, Malverne, N. Y. (to United Merchants and Manufacturers, Inc., New York, N. Y.).

Washfast, flocked film is made by coating a temporary carrier with a liquid dispersion containing polyvinyl chloride, plasticizer, and an organic isocyanate modifier. The dispersion is partially dried to increase its viscosity; flock is adhered to its surface; and dry heat is applied causing it to fuse. The flocked film thus formed is exposed to steam, after which it is removed from the temporary carrier.

Patent Digest (Cont'd.)

Method of Forming Hollow Plastic Articles. No. 2,783,503. Orville B. Sherman, Toledo, O. (to Owens-Illinois Glass Co.).

A length of plastic tubing is removed from a substantially continuous supply source by simultaneously severing and gripping it in such a manner that the end of the supply tube is left open. The severed length is transferred to a mold and expanded by applying fluid pressure through its open end.

Coating Process for Polyethylene and Composite Articles Obtained Thereby. No. 2,786,780. Wilhelm E. Walles and Harold G. Hahn, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

The surface of the polyethylene is sulfonated and treated with a polybasic compound containing at least two amine groups to provide it with a basic reactive polarity. It is then coated with a resinous tripolymer of vinylidene chloride, acrylonitrile, and a functionally-acidic ethenoid monomer.

Applications

Printing Plate. No. 2,791,052. Gustav A. Vasel, Philadelphia, Pa.

A rubber-like backing layer is bonded to a metallized synthetic resin surface layer. The external face of the metallized plastic forms the patterned surface of the printing plate.

Plastic Liners and Plastic Ceiling Liner for Trailers. No. 2,791,463. Semond Levitt, Philadelphia, Pa. (to Fruehauf Trailer Co., Detroit, Mich.).

The liners are constructed of interconnected, rectangular, preformed sections of reinforced plastic. One side of each liner includes an open vertical rib at its inner face, while the opposite side is designed with a vertical hollow rib containing a post. The open vertical rib of one section embraces and is secured to the hollow post-carrying rib of an adjacent section.

Thermoplastic Bag. No. 2,788,039. Gilmore T. Schjeldahl, Farmington, Minn. (to Brown & Bigelow, St. Paul, Minn.).

The bag comprises thermoplastic front and back sheets, the side edges of which are welded by heat fusion to form a strong seal. An open bottom, formed by the edges of the component sheets is adapted to receive material and, subsequently, to be sealed together in a bottom seam. A top closure of thermoplastic coated label stock is folded longitudinally along, and heat sealed to, the open bag top.

Plastic Container. No. 2,790,475. Robert H. Close, Birmingham, Mich. (to Plastray Corp., Detroit, Mich.).

A molded polyethylene container comprises an open top receptacle having external screw threads around its upper edge. A marginal wall, descending from the cover top, terminates in an inner and an outer flanged portion to provide an annular channel which receives the upper portion of the receptacle. The outer flange is provided with an internal screw thread which mates with those of the receptacle proper to draw the two parts into sealing engagement.

Cleat for Football Shoe. No. 2,787,843. Fred C. Phillips, Stoughton, Mass.

A football shoe cleat comprises a frustro-conical nylon member having a central bore extending from face to face. Contained within this orifice is a metal member having at one end a disc-like tip engaging the end face of the nylon frustrum. The metal member has a threaded bore extending part-way from the end opposite the disc, and is provided with longitudinal ridges in its outer surface which grip the walls of the nylon part.

Plastic Hose Nozzle. No. 2,783,094. Lloyd F. Storie, Shaker Heights, O. (to Ulchek Tool Co., Cleveland, O.).

A spray nozzle comprises a spindle member housing a liquid flow passage with inlet and outlet openings at opposite ends. An imperforate sleeve surrounds the spindle and, by axial movement, coacts with the outlet to control the liquid spray. Leakage through the mating threads of the two members is prevented by the action of a ring seal against a cylindrical surface.

Protective Helmet. No. 2,785,404. Elwood Strohm, Southgate, Ky. (to MacGregor Sport Products, Inc.).

A protective helmet is formed by a dome-shaped plastic shell with ear guards on either side. Resilient, plastic-foam front- and rear-rim pads are mounted in the shell and connected by bands of inelastic, woven-glass cloth. Each of the bands extends a substantial distance along the front- and rear-rim pads, so that compression on the front pad will produce tension on the rear pad; and vice versa.

Protective Pad. No. 2,785,407. Leo E. Reeder, Cincinnati, O. (to MacGregor Sports Products, Inc., Cincinnati, O.).

The pad comprises a stiffening core, molded to fit the contours of the wearer. The core is sandwiched between two layers of foamed vinyl plastic extending marginally beyond it. The cushions are cemented together, and the entire assembly is coated with a vinyl resin finish to render it moisture-proof.

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Current Market Prices

Price Changes and Additions

Stabilizers			
Ferro liquid stabilizers:			
203	lb.	$0.84 /	$0.97
703	lb.	.62 /	.75
707X, 760X	lb.	.92 /	1.05
900	lb.	.87 /	1.00
903	lb.	.57 /	.70
904	lb.	.81 /	.94
909	lb.	.87 /	1.01
1203	lb.	1.35 /	1.48
1206	lb.	1.29 /	1.42
1212A	lb.	.67 /	.80
Powdered stabilizers:			
182	lb.	.67 /	.76
503	lb.	.27 /	.40
541A	lb.	.79 /	.92
768, 1825	lb.	.97 /	1.10
1820	lb.	.87 /	1.00
1827	lb.	1.02 /	1.15
1840	lb.	.72 /	.85
1972	lb.	.62 /	.75
1976	lb.	.44 /	.57
Vanstay A	lb.	.51 /	.53
AB	lb.	.47	
CD	lb.	.46 /	.48
HT	lb.	.88 /	.90
L	lb.	.33 /	.35
R, X	lb.	.68 /	.70
RZ-25	lb.	.67 /	.69
S	lb.	.58 /	.60
W	lb.	1.23 /	1.25
Z	lb.	.63 /	.65

CALENDAR of COMING EVENTS

The calendar is a little short this month, since many of the SPE Sections have canceled their regular meetings due to the ANTEC in Detroit. Incidentally, we would like to take some of this space to ask other Sections of SPE, and SPI Chapters to send in reports of their meetings. We can, in turn, summarize them in our Society News Section. We would also like to know your meeting places and dates (assuming the back of the SPE membership card does not list it exactly), so that this calendar can be completely correct.
Thank you.

The two big meetings at this time of year are:

January 28-31
SPE Annual Technical Conference. Sheraton-Cadillac Hotel, Detroit, Mich.

February 4-6
SPI Reinforced Plastics Division Conference. Edgewater Beach Hotel, Chicago, Ill.

In Brief . . .

Plax Corp., has announced a 5% price reduction for its Polyflex 100 series of biaxially-oriented polystyrene. This reduction covers thicknesses of 2-10 mils.

Union Carbide Chemicals Co., has opened a bulk terminal in St. Louis, Mo. Chemicals will be received by barge, and will be shipped out by tank car or tank truck.

Pfaudler Co., has established a southern sales district, with headquarters in Houston, Tex. A. G. Anderson has been named its manager.

Westchester Plastics, Inc., has opened a color blending laboratory, designed to investigate problems in the development and control of exacting color shades.

Minnesota Mining & Mfg. Co., has opened a branch office and warehouse at 4835 Para Drive, Cincinnati, O. The two-story concrete structure has more than 47,000 square feet of floor space.

American Molding Co., has set up engineering and sales offices at 6057 Wilson Ave., Hollydale, Calif. Albert J. Sills has been named to head the operation.

General Tire & Rubber Co.'s Textileather division has introduced the 1958 Holiday line of vinyl upholstery. Colors include marigold, smoke, violet, apple red, peacock blue, strawberry, bronze, tangerine, orange, sand, surf green, beige, toast, toast brown, turquoise blue, and lemon yellow. Patterns include a new Holiday pattern, Londonderry, Springtime, Louvaine, Straw, and Cirrus.

Tracerlab, Inc., has opened a new subsidiary, Tracerlab, N. V., with offices in Amsterdam, Holland.

G. Felsenthal & Sons, Inc., has added nine new offices and four manufacturer's representatives. Offices and managers are: Thomas A. Perrott, Arlington, Va.; Noel Crouch, R. R. Noland Co., Minneapolis, Minn.; Emerson Johnson, Racine, Wis.; and the Maury E. Bettis Co., headquartered in Kansas City, Mo. The latter firm also maintains offices in St. Louis, Mo., Cedar Rapids, Ia., Wichita, Kans., Tulsa, Okla., and Little Rock, Ark.

E. I. du Pont de Nemours & Co.'s industrial finishes division has announced price reductions up to 44% on adhesives for Mylar film. Prices of liquid polyester solutions in drum lots are reduced 9-34% in a range of six types, and solid polymers of four types are cut 32-44%.

Canadian Resins & Chemicals, Ltd., has signed an agreement with Consolidated Dyestuffs & Chemicals, Ltd., whereby it becomes exclusive sales agent in Canada for certain products manufactured by Badische Anilin & Soda Fabrik, A. G. The pact covers chemicals for the plastics and paint industries.

General Electric Co.'s chemical materials department has consolidated its sales headquarters for Glyptal alkyd and polyester resins with the manufacturing facilities at 1211 North Olive St., Anaheim, Calif. A San Francisco sales office was set up at 436 Peninsular Ave., San Mateo, Calif., and R. M. Kavish will serve as company representative.

Domestic Production and Sales of Plastics and Resin Material, July and August, 1957

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of July and August, 1957. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Production and sales of cellulosics, phenolics, ureas, styrenes, coumarone-indenes and polyesters showed fluctuation of small magnitude with respect to the 1956 figures for this period. Vinyls and vinyl chlorides registered appreciable gains during July, while polyethylene production and sales rose sharply during both months.

	July, 1957		August, 1957	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.03 gage	1,390,489	1,350,789	1,600,378	1,562,281
Sheets, 0.003 gage and over	1,008,913	1,256,964	1,569,531	1,510,572
All other sheets, rods, and tubes	472,495	513,023	410,147	413,237
Molding and extrusion materials	6,620,929	6,388,154	7,200,130	7,738,728
Nitrocellulose sheets, rods, and tubes	233,087	299,297	318,219	299,674
Other cellulose plastics	340,865	262,411	511,479	464,847
TOTAL	10,066,778	10,070,638	11,609,884	11,989,339
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	12,025,031	11,858,278	12,983,775	15,710,431
Bonding and adhesive resins for—				
Laminating (excpet plywood)	4,098,678	3,499,813	5,541,963	4,233,740
Coated and bonded abrasives	965,402	1,116,692	1,327,961	1,370,655
Friction materials (brake linings, clutch facings, and similar materials)[7]				
Thermal insulation (fiber glass, rock wool)	4,699,458	4,873,648	5,243,217	5,215,938
Plywood	3,579,350	2,870,264	3,858,540	2,930,716
All other bonding and adhesive uses	4,984,569	4,444,790	4,647,602	4,763,777
Protective-coating resins, unmodified and modified except by rosin	1,635,049	1,535,256	2,256,621	2,178,014
Resins for all other uses	2,254,800	1,958,240	3,440,117	2,316,267
TOTAL	34,242,338	32,156,982	37,299,796	38,719,538
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	1,864,189	2,029,724	2,702,372	2,838,899
Paper-treating and Paper-coating resins	1,900,860	1,869,781	1,864,254	1,950,042
Bonding and adhesive resins for—				
Plywood	6,715,003	6,865,672	8,164,442	7,537,400
All other bonding and adhesive uses, including laminating	2,556,313	2,466,538	3,338,887	2,808,341
Protective-coating resins, straight and modified	2,526,992	1,784,692	2,639,186	2,050,179
Resins for all other uses, including molding	5,020,242	6,507,741	7,419,159	7,434,867
TOTAL	20,583,599	21,524,148	26,128,300	24,619,728
Styrene Resins:				
Molding materials[1]	29,006,730	32,361,204	35,030,291	33,290,823
Protective-coating resins, straight and modified	6,024,033	7,065,126	6,566,463	6,145,104
Resins for all other uses	9,882,399	8,652,739	11,489,498	9,730,959
TOTAL	44,913,162	48,079,069	53,086,252	49,166,886
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		6,342,283		7,120,724
Sheeting (resin content		4,362,246		4,941,462
Molding and extrusion (resin content)		14,340,496		17,962,196
Textile and paper treating and coating (resin contents)[3]		5,371,617		6,883,971
Flooring (resin content)		6,029,665		7,552,609
Protective coating (resin content)		2,775,423		2,514,788
All other uses (resin content)		2,872,494		4,251,978
All other vinyl resins for—				
Adhesives (resin content)		3,236,439		3,676,722
All other uses (resin content)		7,976,241		9,011,115
TOTAL	63,271,556	53,286,904	72,262,990	63,915,565
Coumarone-Indene and Petroleum Polymer Resins	21,602,821	20,713,463	23,513,186	23,447,990
Polyester Resins	7,209,343	6,825,501	7,335,543	7,081,189
Polyethylene Resins	55,356,790	50,581,685	58,349,389	55,340,307
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1], [4]	3,834,142	3,517,668	3,555,177	4,061,246
Protective-coating resins[5]	1,031,994	564,983	1,212,670	505,496
Resins for all other uses[6]	10,594,125	9,515,788	11,758,165	12,018,813
TOTAL	15,460,261	13,598,439	16,526,012	16,585,555
GRAND TOTALS	272,706,648	256,836,829	306,111,352	290,866,007

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-types resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
SOURCE: United States Tariff Commission, Chemical Division.

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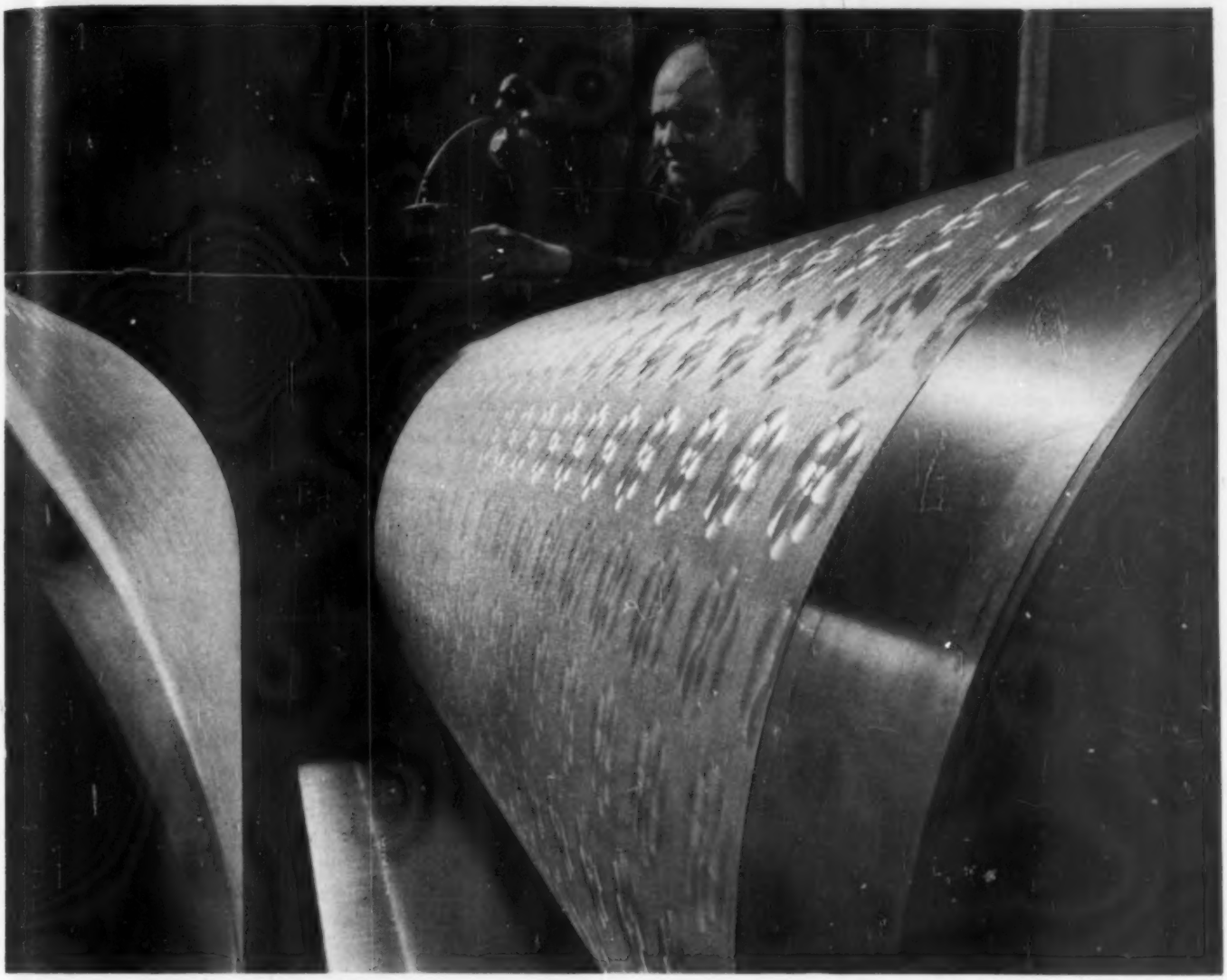

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Now—3-D and fluorescence, too

Coming off the calender above is a *doubly new* kind of vinyl film that has a striking, three-dimensional appearance and a never-before-achieved fluorescent color.

The three-dimensional effect is obtained through a unique embossing which utilizes Fresnel's theory on the absorption and reflection of light. The distinctive color is achieved through extra-careful compounding and processing of the heat-sensitive fluorescent pigments.

A major role in the successful production of this unusual film is played by PLIOVIC. Because it premixes and fuses at low temperatures, PLIOVIC minimizes heat degradation of both resin and pigment. It also embosses easily and provides excellent heat sealability. Other advantages are good heat and light stability and good, general physical properties.

The particular PLIOVIC used in this three-dimensional film is one of a family of vinyl resins designed to give you improved processing and/or end properties. For details plus the latest *Tech Book Bulletins*, just write to: Goodyear, Chemical Division, Akron 16, Ohio.

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POLYETHYLENE PROCESSING TIPS

RESIN PROPERTIES THAT AFFECT STRESS-CRACK RESISTANCE OF POLYETHYLENE

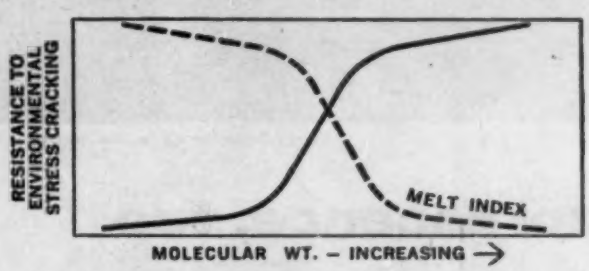
Environmental stress cracking is the term used to describe a certain type of material failure. With polyethylene this failure occurs when the plastic is under high local stress (either external or internal) and in contact with materials such as a soap, detergent, or solvent, which affects the polymer.

Resistance to stress cracking is especially important for applications such as electrical insulation, polyethylene pipe, housewares, and certain types of packages.

Two factors influence the resistance of a polyethylene part to environmental stress cracking: the resin used and the conditions used in fabricating the part.

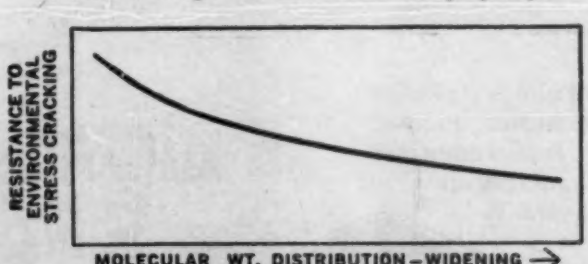
Which resin to use:

Stress crack resistance is greater with a resin of ***higher molecular weight*** – that is, lower melt index.



Then why not use low melt index resins? Because production rates are lower. The processor must make a compromise between peak production rate and top stress-crack resistance and use a resin that will be satisfactory, if not ideal, in both respects.

Molecular weight distribution of the polyethylene resin is important too. Resins with a narrow molecular weight distribution (with fewer molecules much higher or lower than the average) have better stress crack resistance than those with wide molecular weight distribution (more of the larger and smaller molecules but the same average). The low molecular weight fraction is more susceptible to attack by environmental materials.



However, the flow properties of a polyethylene resin having a narrow molecular weight distribution and a given melt index are not as good as those of a polyethylene resin having a wide molecular weight distribution and the same melt index. Here again the processor must make a compromise between production rate and the properties he requires in the end product.

Density of the resin will also have an effect on the resistance of that polyethylene resin to environmental stress cracking. The higher the density, the poorer resistance to environmental stress cracking. On the other hand, the more linear or more dense polyethylenes have enhanced flow properties and higher stiffness and tensile strength.

There is no single answer to all problems

It is obvious from the preceding discussion that there is no simple solution to the selection of a resin for a particular end use. The resin must be carefully selected while giving proper consideration to the important end properties required in the fabricated article.

An answer to your particular problem can be found by obtaining a polyethylene resin from a manufacturer who can give you the balance of properties required – high or low melt index, narrow or wide molecular weight distribution, a range of densities. U.S.I. is one such supplier and their Technical Service Representatives stand ready to assist you in the selection of the proper Petrothene resin.

Processing conditions affect stress crack resistance

Processing temperatures, cooling rates, and other processing conditions can have a marked effect on stress crack resistance, because of residual strains left in the fabricated article.

There isn't room to go into these in detail here but the next issue of "Tips" will discuss them more fully.

Meanwhile if you have a specific problem, call on U.S.I.'s Technical Service Engineers. They will be glad to work with you toward finding a solution.

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How much cure time

can you save with

BAKELITE Phenolic BMM-7000

BRAND

...SEE THE FOLLOWING PAGE....

see how these companies have saved:

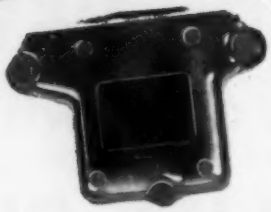
- Bryant Electric Co.
- Gilbert Manufacturing Co., Inc.
- Kuhn & Jacob Molding and Tool Co.
- Sylvania Electric Products Inc.

BMM-7000 CURES FASTER THAN ANY OTHER GENERAL-PURPOSE PHENOLIC... AND AT NO PREMIUM PRICE!

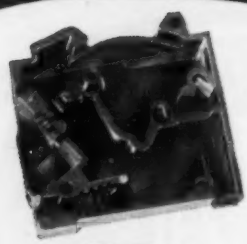
BMM-7000 is a general-purpose two-step wood-flour-filled phenolic molding material. Its cure speed is exceptional — faster than either two-step or very fast one-step materials. Intended for cold powder automatic molding, BMM-7000 can also be plunger molded on fast cycles.

YOU GET
- MORE FREEDOM IN MOLDING
- FASTER CURING SPEEDS
- BIGGER SAVINGS

Look at how cure time was cut for these pieces!



27% less time



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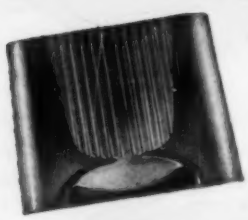
17% less time



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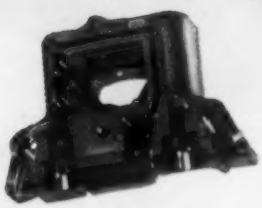
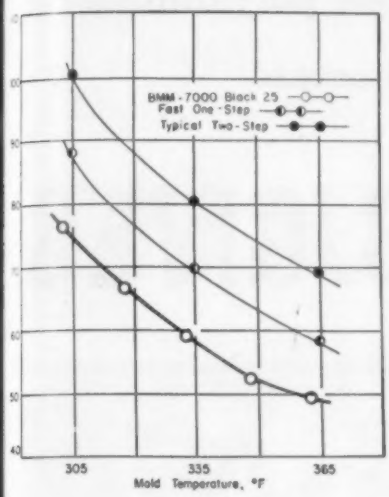


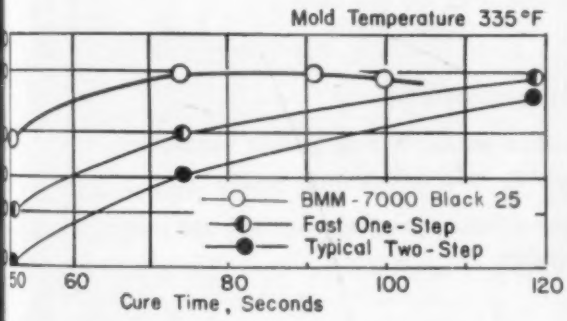
40% less time

HERE ARE SOME FACTS:

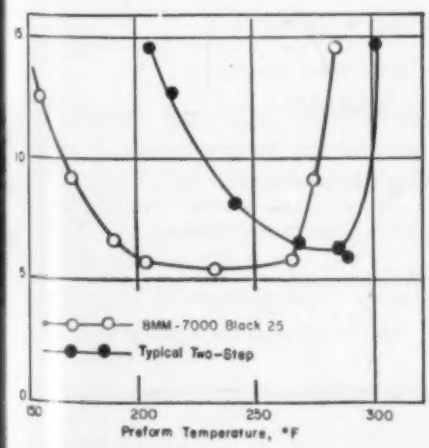
FAST CURE SPEED—BMM-7000 cured as fast at 315 deg. F. as a fast one-step material at 335 deg. F., and a two-step material at 365 deg. F., according to a test of minimum blister-free time in cold powder compression molding.



HOT RIGIDITY—BMM-7000 took 50 seconds to reach an apparent modulus of elasticity of 50,000 psi at 335 deg. F. A fast one-step phenolic took 50 per cent longer, a typical two-step material, 100 per cent longer.



MOLDING LATITUDE—As determined by plunger molding, BMM-7000 could be preheated over a wider range than general-purpose BMG-5000, and still give mold fill-out—an 87 deg. F. spread at 7500 psi, compared to 46 degrees for BMG-5000. This property makes the new material suitable for molding large pieces even with its fast cure speed.



IN ADDITION—BMM-7000 demonstrates good mold release, freedom from mold staining, low specific gravity, and low shrinkage.

TYPICAL TEST VALUES OF BAKELITE BRAND GENERAL-PURPOSE PHENOLIC COMPOUND BMM-7000

BMM-7000 BLACK 25
TYPICAL TEST VALUES

VALUES RELATING TO FABRICATION

Granulation (D392-38)	12 mesh*
Bulk Factor (D392-38)	2.3
Tableting Qualities	Easily preformed on standard equipment.
Pourability (D392-38), sec.	19
Plasticity Grades Available	6, 9, 12
Molding Shrinkage (D955-51), in./in.	0.004

*All grades supplied in special low fines granulation.

VALUES FROM ELECTRICAL TESTS

Dielectric Strength (D149-55T)			
Short time, volts/mil	330		
Volume Resistivity (D257-54T)			
ohm-cm	6×10^{12}		
	60C	1 KC	1 MC
Dielectric Constant (D150-54T)	6.1	5.7	4.6
Dissipation Factor (D150-54T)	0.08	0.04	0.03

VALUES FROM MISCELLANEOUS TESTS

Molded Specific Gravity (D392-38)	1.36
Heat Distortion Temperature (D648-45T) deg. F.	330
Water Absorption (D570-54T) % wt. gain	0.5

VALUES FROM MECHANICAL TESTS

Izod Impact Strength (D256-54T) (Ft. lb./in. of notch)	0.29
Compressive Strength (D695-54), psi	35,000
Tensile Strength (D651-48) (⅛"), psi	6,900
Flexural Properties (D790-49T):	
Flexural Strength, psi	9,000
Modulus of Elasticity in Flexure, psi	9.5×10^5

WRITE FOR MORE FACTS...
TEST IT YOURSELF!

Molders who have already tried this new general-purpose phenolic have found it an impressive time-saver. Find out for yourself,—try it in your own operations. Write for complete data and samples to Dept. AU-130.

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BRAND
PLASTICS

UNION CARBIDE

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30 East 42nd Street, New York 17, N.Y.

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High compatibility with many resins

Grease and oil resistance in resins

Improved flexibility in nylon and related polyamides

Better adhesive qualities in polyvinyl acetate

ONLY SANTICIZER 8 GIVES Y

SANTICIZER 8

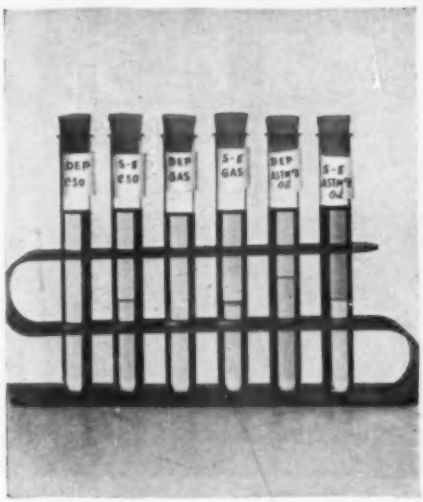
Resin	Maximum Compatibility PHR*	Outstanding Properties and Characteristics
Cellulose Acetate	90	High brilliance and gloss. Good water, grease, and scuff resistance.
Phenolic Resins	50	Slight flexibility. Improved punching characteristics for laminates.
Acrylic Resins	25	
Cellulose Acetopropionate	100	High compatibility.
Nitrocellulose	80	Excellent moisture and grease resistance, flexibility and adhesion in lacquers.
Polyvinyl Acetate	100	High adhesion, grease resistance and flexibility.
Ethyl Cellulose	60	
Polyvinyl Butyral	100	
Shellac	40	High adhesion and flexibility.
Santolite Resins	50	Combinations with Santicizer 8 excellent in nitrocellulose lacquers.
Protein Compounds	50	In Zein, S-8 improves flexibility, water resistance, gloss and adhesion.
Melamine Resins	50	Slight flexibility. Improved punching characteristics for laminates.
Nylon and Other Polyamides	high	Flexibility at room and low temperatures. Reduces processing temperatures.
Casein	65	Flexibility, scuff, and grease resistance.
Allyl Starch	20	Grease and scuff resistance.

*PHR—Parts of plasticizer per hundred of resin

1. High compatibility with many resins.

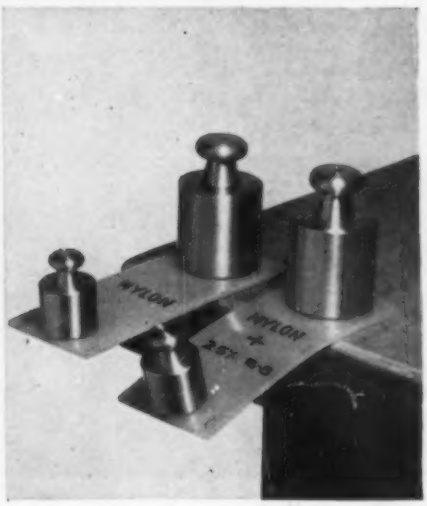
As this listing shows, Santicizer 8 is an unusually versatile primary and secondary plasticizer.

YOU ALL THESE ADVANTAGES



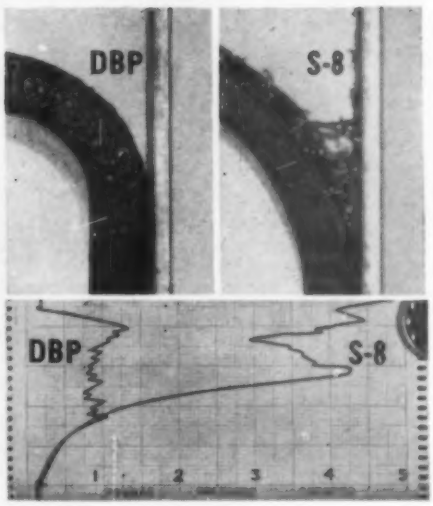
2. Grease and oil resistance in resins

Santicizer 8 is practically insoluble in aliphatic hydrocarbons. The miscibility test above compares the resistance of diethyl phthalate and Santicizer 8 against cottonseed oil, gasoline, and ASTM #3 oil. Santicizer 8 (in the second, fourth and sixth test tubes) proves much superior. Santicizer 8 and nitrocellulose plus Monsanto Santolite resins produce lacquers that are unaffected by gasoline, fats and oils.



3. Improved flexibility in nylon and related polyamides

Santicizer 8 is one of the best plasticizers known for synthetic polyamides such as nylon and related resins. By extending these resins, it lowers cost. It also lowers melting point, improves toughness and flexibility — especially low-temperature flex—without adversely affecting other properties. The more flexible nylon sheet shown above is nylon with 25% Santicizer 8.



4. Better adhesive qualities in polyvinyl acetate

In polyvinyl acetate, Santicizer 8 produces stable adhesives with good adhesion and flexibility. The test above shows the better rubber-to-metal adhesion of polyvinyl acetate with Santicizer 8 over that with dibutyl phthalate. Santicizer 8 also imparts excellent adhering properties to polyvinyl-acetate hot melts for bookbinding and shoe adhesives.

Want to improve any of these products?

Grease-resistant paper; lacquers and other coatings that resist gasoline, oil, other petroleum products . . .

Nylon and related resins . . .

Adhesives for bookbinding, shoemaking, binding rubber to metal . . .

Laminates . . .

Our Technical Service Department will help you test Santicizer 8 in your operation. Monsanto supplies almost FIFTY different plasticizers of SEVEN basic types. Call on Monsanto for one-stop service, mixed bulk shipments at bulk prices, and expert technical advice.

With no vested interest in any single plasticizer, Monsanto develops plasticizing systems tailor-made to fit your needs.

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division, Dept. PL-9, Box 478, St. Louis 1, Mo.
In Canada: Monsanto Canada Ltd., Montreal

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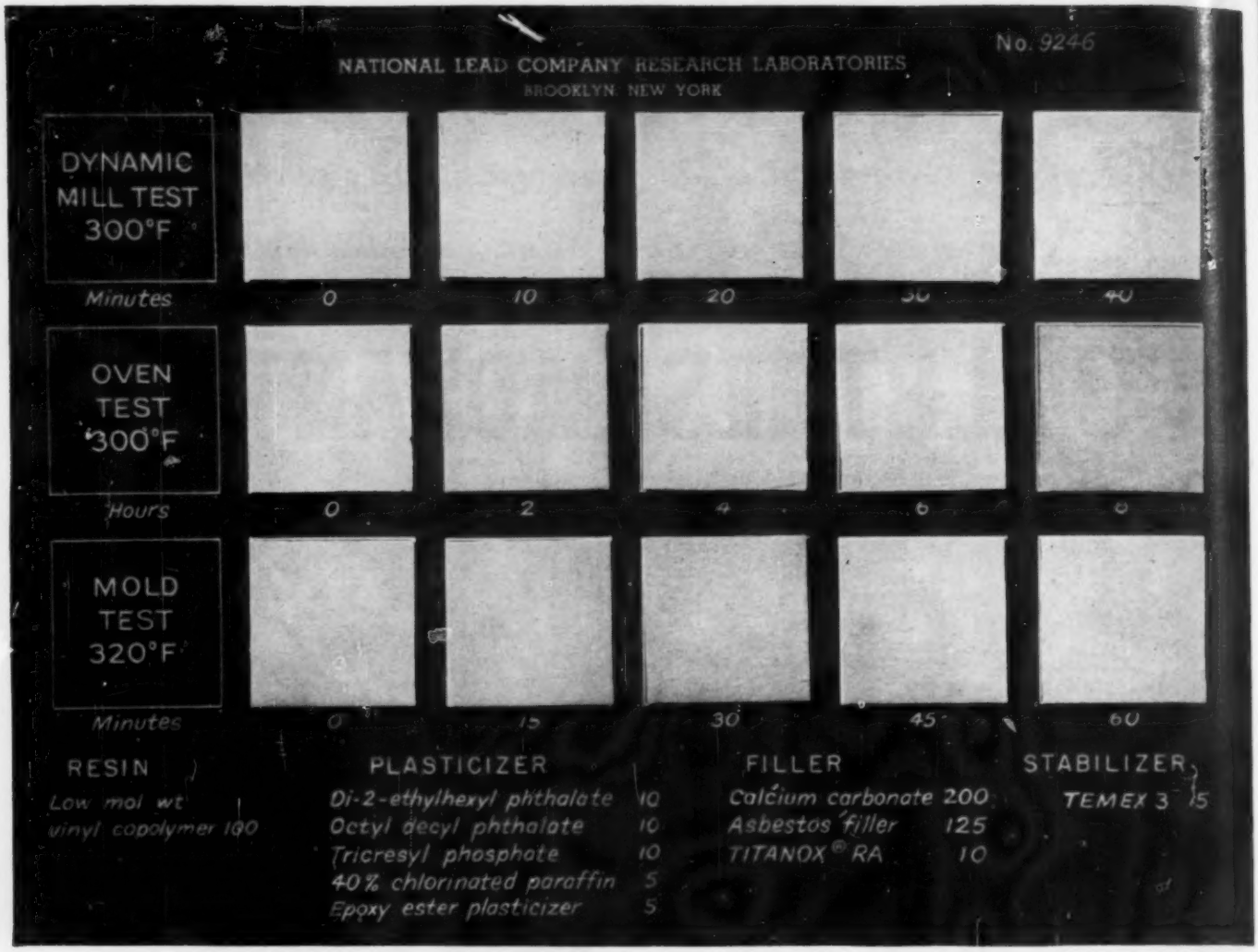

How's this for color retention?

New stabilizer..."Dutch Boy" Temex 3... gives 3-way better color control in vinyl-asbestos flooring

This test card shows what you can expect from asbestos-filled vinyl flooring stocks stabilized with the new "Dutch Boy" stabilizer . . . Temex 3.

In these stocks, this specially-developed barium-zinc compound gives you a 3-way better control over color during processing:

Best yet for heat stability

Mill, mold and oven tests are alike in demonstrating that "Dutch Boy" Temex 3 stabilizer provides greater heat stability than ever before attainable for vinyl asbestos-filled flooring.

Complete freedom from interactive color change

Temex 3 stabilizer has minimum reactivity . . . does away with pinking, bluing and other color shifts associated with interaction between stabilizer and filler impurities.

No harmful lubricity

Temex 3 stabilizer adds no lubricity to the compound. At any recommended level of stabilizer, critical color values in whites and pastels can be maintained . . . color separations kept sharp.

Steps up color life, too

Along with improved color control during processing, "Dutch Boy" stabilizer Temex 3, also assures improved color life after flooring is laid . . . preventing discoloration or staining by sulfur compounds.

Other "Dutch Boy" stabilizers meet other vinyl flooring needs . . . Tribase and Normasal®, for other loaded stocks . . . Clarite®, for homogeneous non-asbestos stocks. Still others . . . seventeen more, in fact . . . improve other vinyl products.

Seeking to improve *your* vinyl formulations? If so, look into these versatile "Dutch Boy" stabilizers. A new edition of the "Dutch Boy" Stabilizer Handbook is available. Ask for a copy.

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY
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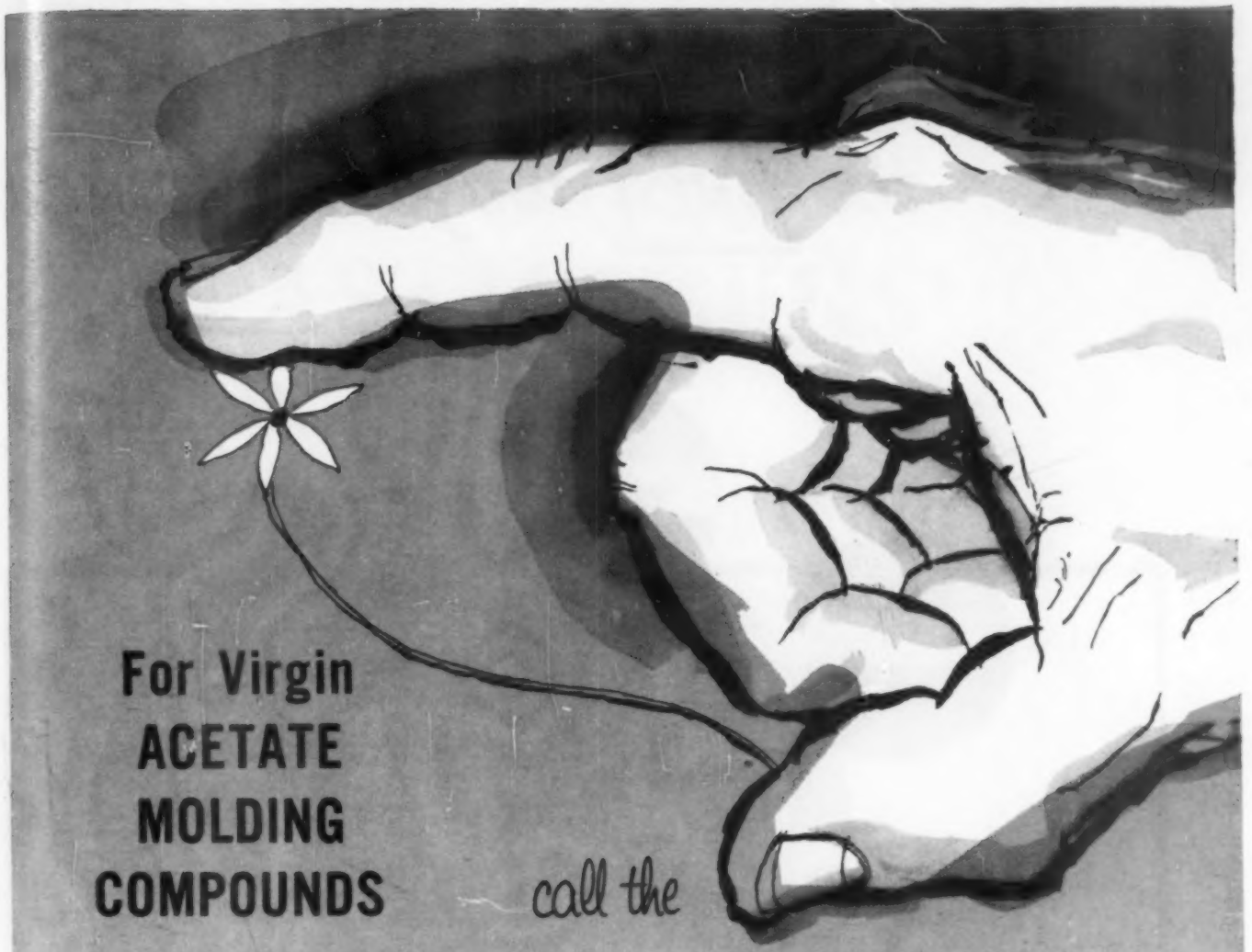
In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West, Montreal



For Virgin ACETATE MOLDING COMPOUNDS

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GIANT

with the delicate touch

Gering is a prime source for Virgin Acetate Molding Compounds formulated to **exact** flow and physical properties specifications. Available for every extrusion or injection molding need . . . in crystal and a full range of colors from the most delicate transparent to the deepest opaque.

With Gering's efficient, giant-size custom-compounding operation you can be sure of competitively priced virgin acetate of the highest quality. And you'll get speedy delivery, no matter how large your order . . . that's the Gering difference!

Over 30 years of prompt response to customer's individual needs has earned Gering an unrivaled reputation as "color compounding specialists". In addition, this service is combined with a rigid step-by-step system of quality controls, complete laboratory facilities, and modern production equipment—all under topnotch technical supervision. Write us about your specific needs today.

Check these Virgin Acetate groupings for your exact needs.

Group 1—Recommended primarily for extrusion but can also be used for injection molding. Crystals and extremely delicate transparent colors can only be furnished in this group. The full range of opaque colors and metallics are also available in this group.

Group 2—Recommended for injection molding only. For all opaque, transparent, translucent and metallic colors with the exception of crystal and extremely delicate transparent colors.

Group 3—Recommended for injection molding only. Available in the full range of opaque colors.

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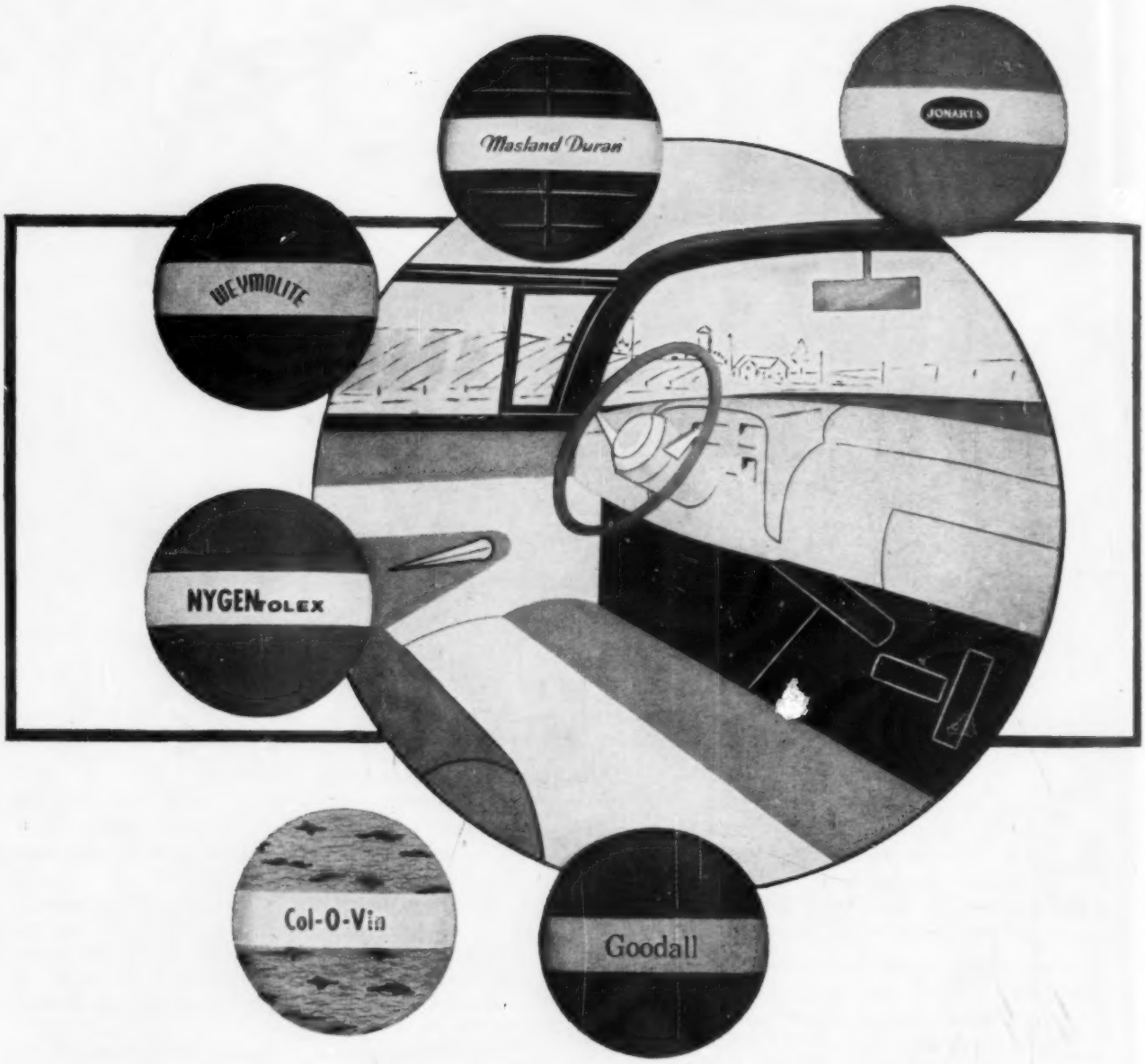

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The famous names at left sell a major share of the upholstery fabrics you see in America's cars today. These high-quality vinyls are designed specifically to satisfy the demands of modern motorists for appearance *and durability!* Nothing is spared in using raw materials that produce the highest possible quality. That's why leading manufacturers use Emery Plastolein Plasticizers, to get that extra quality that makes their fabrics perform so well for so long.

If *you* are interested in producing high quality sheeting, coated fabrics, film and extrusions, you *too* should use Plastolein Plasticizers in your plasticizer system. The coupon below will bring you all details about the unsurpassed low-temperature performance of Plastolein 9058 DOZ, the outstanding permanence of Plastolein 9720 Polymeric, as well as data on other Emery Plastolein Plasticizers. Mail it today.

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Please send me the 32-page Emeryfacts titled, "Plastolein Plasticizers."

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WALDRON PLASTIC EMBOSSER

. . . the real test of designing skill

For many years, Waldron Engineers have studied the problems faced by the machine designer and have evolved several types for this purpose, with either radiant or drum preheating. In them Waldron Engineers found satisfactory answers to such problems as:

- faithful and consistent reproduction of patterns, both deep and shallow
- proper operating temperatures
- stretch and loss of width
- rewind tension
- speed in changing embossing rolls
- faithful reproduction of runs
- handling different varieties of plastics at suitable speeds

There's no tougher problem in processing webs than those presented by the plastic web, particularly the embossing unit. A plastic web is a tricky thing to handle . . . as temperamental as they come and in many ways completely unlike paper, textile or metal webs.

The proof that Waldron Engineers found the answer to these problems (listed at the left) can be found in the many machines in service today. They bear witness to the sound principles embodied in the design. Sound engineering principles, we believe, are what you will want in that embosser you plan to buy.

THE ROSS GROUP OF COMPLEMENTING SERVICES

J. O. ROSS ENGINEERING CORPORATION . . . New York
ROSS EMBOSSING OF CANADA LIMITED . . . Montreal
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MARLEX* 50 POLYETHYLENE Makes Tough, Colorful Rope

Here is a brand new cordage material that is stimulating the interest of rope users everywhere! Filaments made from MARLEX 50 have a tensile strength varying from 50,000 to as high as 150,000 psi, according to diameter and draw-down.

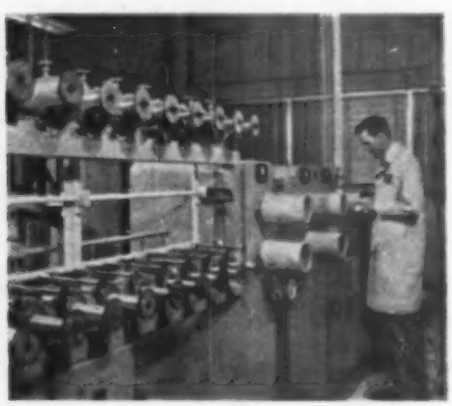
MARLEX 50 polyethylene is a high-modulus material that produces filaments with excellent tenacity, superior resistance to moisture and chemicals, along with *low-temperature flexibility*. Applications are many and varied—from surgeons' sutures to tugboat hawsers.

Don't delay . . . get in touch with your MARLEX sales representative today. Ask him to demonstrate for you the advantages of this amazing new low-cost material.

MARLEX SALES SERVICE LABORATORY

This new Sales Service Lab in Bartlesville is completely equipped with latest processing machinery and research apparatus. Phillips experienced technical service staff will assist you in developing new products and processes using MARLEX plastics. Please make arrangements through your MARLEX sales service representative.

Rope made from this revolutionary new polyethylene actually *floats . . . does not absorb water!* Thus, there is no swelling and consequent strand structure deformation when used in marine and other outdoor applications. Strength, endurance, heat resistance and light weight of MARLEX 50 rope will add to its popularity.



Filament spinning section at the Sales Service Lab, where MARLEX plastics specialists are constantly evaluating new manufacturing techniques and applications for MARLEX 50 filaments. They have discovered that filament elongation of this new plastic can be varied by orientation during processing from 5% to 30%, adding greatly to its versatility as a material.

*MARLEX is a trademark for the Phillips family of olefin polymers

PLASTICS SALES DIVISION, PHILLIPS CHEMICAL COMPANY

A Subsidiary of Phillips Petroleum Company, Bartlesville, Oklahoma

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VYGEN fits into your wire insulation production picture, regardless of size, equipment, or technique. VYGEN 120 for the operator doing his own compounding—VYGEN 6812 compound for the operator desiring a ready-to-extrude material—either one gives the very finest of finished products, and both are completely tested and UL-approved. So for the best in wire insulating material, specify the VYGEN made for your operation. And if technical service is necessary, just drop us a line.

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Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO.® VYGEN®

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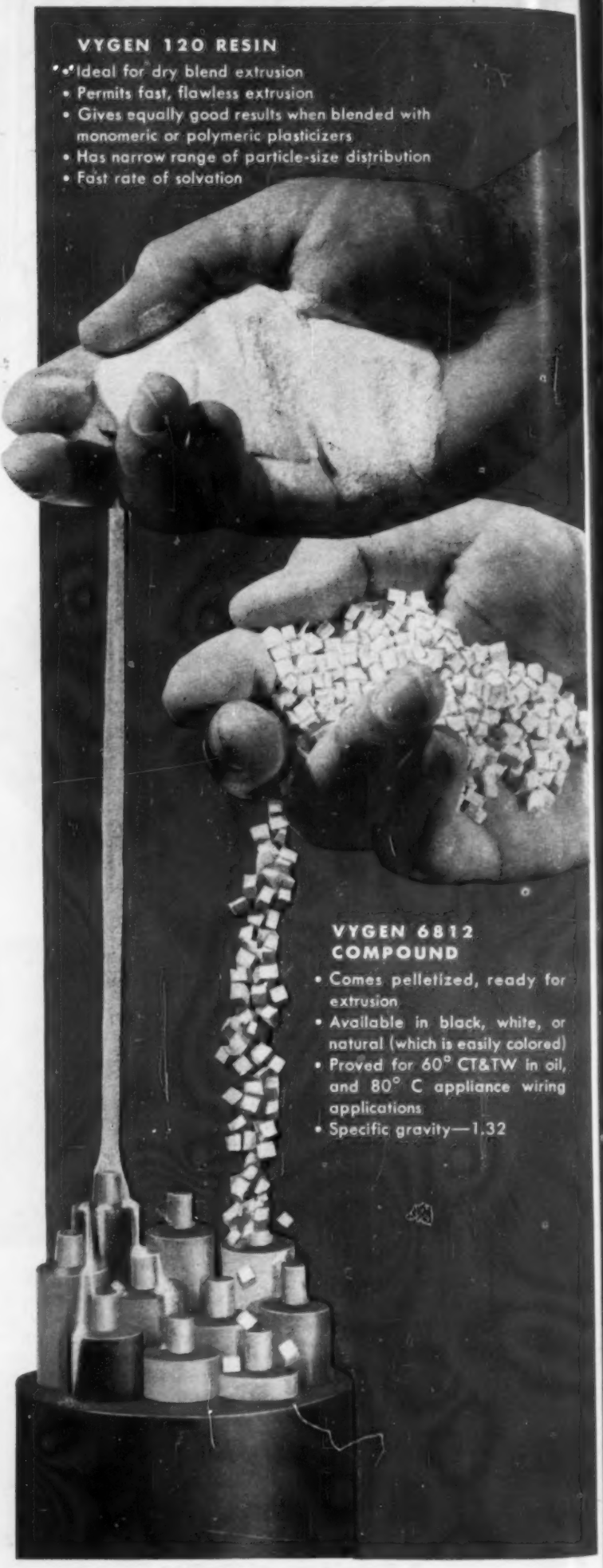
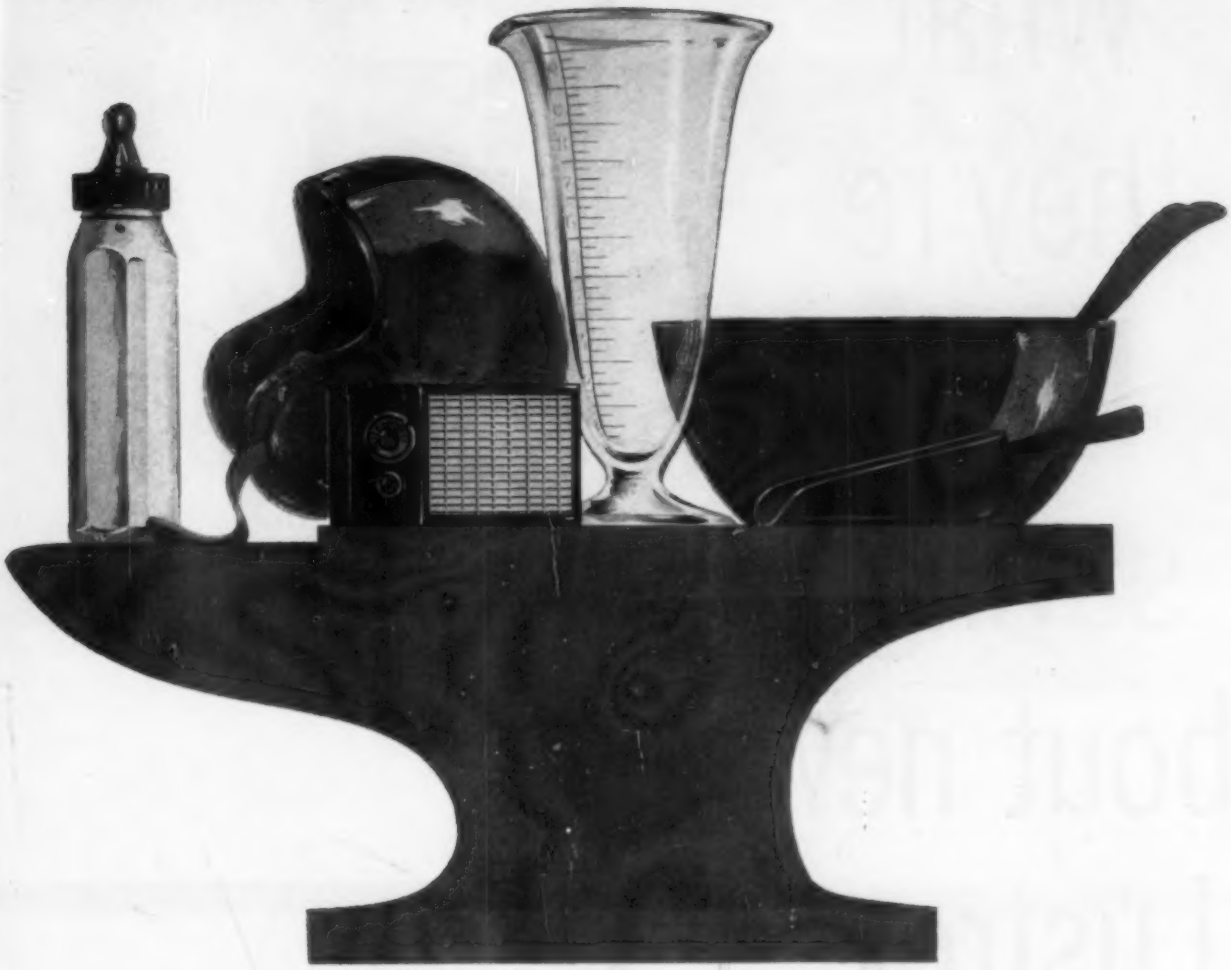
Through Chemistry


VYGEN 120 RESIN
• Ideal for dry blend extrusion
• Permits fast, flawless extrusion
• Gives equally good results when blended with monomeric or polymeric plasticizers
• Has narrow range of particle-size distribution
• Fast rate of solvation
VYGEN 6812 COMPOUND
• Comes pelletized, ready for extrusion
• Available in black, white, or natural (which is easily colored)
• Proved for 60° CT&TW in oil, and 80° C appliance wiring applications
• Specific gravity—1.32

For sturdy plastics . . .



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GREX*

GREX, new high density polyethylene, offers a combination of vastly improved properties that broadens sales potential for plastic fabricators and their customers as well.

For example, GREX brings to industrial moldings impact and tensile strength far superior to many costlier molding materials. GREX-made hospital items that require sterilization and chemical cleaning, won't wilt, stay like new. In refrigerator containers and trays, GREX stays brittle-free, demonstrating resistance to extreme cold. GREX makes top-grade electrical insulation. Film made from GREX features good 'slip' and is suitable for high speed packaging. It is easily heat sealed and is an effective moisture barrier.

Toughness, durability, boilability—learn how these and other improved properties of GREX can help *you* turn out better made, faster selling plastics! Mail the coupon today!

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What they're **both** saying about new Lustrex* Hi-Test 88B

Both extruders and formers have found Lustrex Hi-Test 88B extrusion-grade is an extremely versatile high impact styrene compound. It answers the extruder's need for a material that can produce sheet particularly qualified for vacuum forming high-grade lighting fixtures, packaging, toys or industrial applications requiring high-impact strength. For complete technical information, write Monsanto Chemical Company, Plastics Division, Room 1860, Springfield 2, Mass.

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*LUSTREX: REG. U. S. PAT. OFF.

extruders:

"Fast Extrusion . . .
Excellent Gloss . . .
Smooth Surface Finish!"

vacuum formers:

"Excellent Flow . . .
Uniform Thickness . . .
Even Residual Strength!"

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MONSANTO'S *CONQUEST*
SCIENCE SPECTACULAR
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"We like the fast rate at which Lustrex Hi-Test 88B can extrude sheet on standard machines."

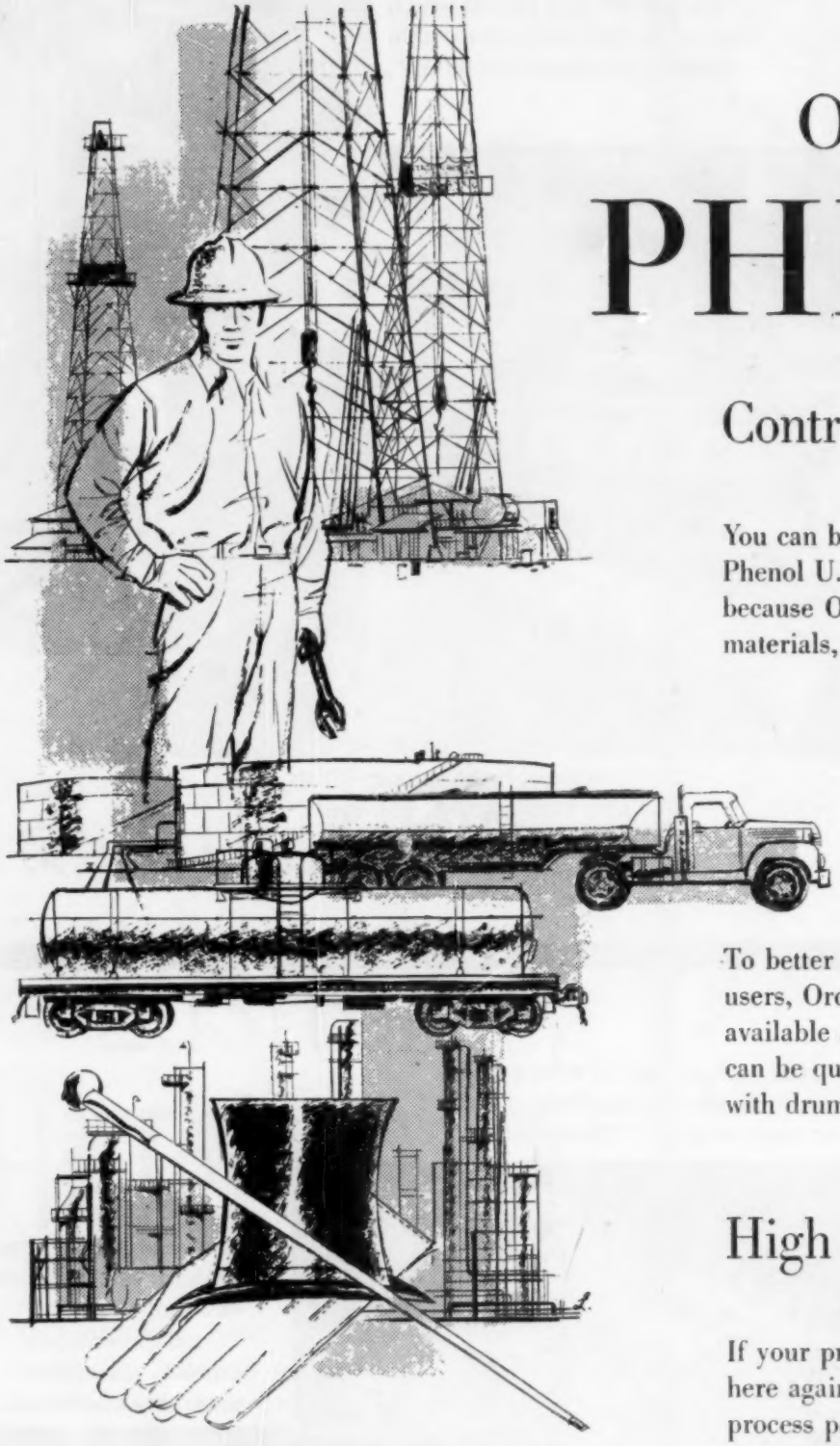
"Uniform dry colorability."
"Excellent gloss in all colors . . ."
"whiter' whites . . ."

"The sheet has a smooth finish . . ."
"free from streaks, fish-eyes . . ."
"more re-usable scrap . . ."

"Complex shapes with no loss of strength . . ."
"Deep draw molding with no sacrifice of wall thickness or toughness . . ." "Sharp detail . . ."

xcellent flow. Sheet fills
t mold very uniformly."
linimum blow-outs in
ep drawing."

"Formed product has uniform thickness and residual strength."
"Good dimensional stability facilitates assembly operations."



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You can be assured of Oronite as a dependable Phenol U.S.P. source, now and years ahead, because Oronite has complete control of raw materials, starting with crude petroleum stocks.

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If your process requires a highly pure product, here again Oronite's advanced manufacturing process permits consistent high quality Phenol to meet your requirements.

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Oronite Acetone is co-produced with Phenol in the world's most modern plant, employing the newest manufacturing process and equipment. Unsurpassed in quality, Oronite Acetone is available nationwide in tank cars, tank trucks and drums.

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ESCAMBIA PVC 1250—High molecular weight resin, recommended for dry blend extrusion of shapes and profiles and for calendered film.

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ESCAMBIA PVC 1200—Lowest molecular weight in this series with outstanding heat stability not generally associated with resins of this molecular weight. It is recommended for calendering, extrusion and molding when lower processing temperatures are required.

NEED A SPECIAL TYPE PVC? Your needs for a special type of PVC will get prompt attention at Escambia. The answer to your production problem may be among the many types of specialty PVC's developed by Escambia's research department: modified and unmodified low molecular weight PVC, conventional and novel copolymers, PVC's for various rigid applications and others. Direct your inquiries to the address below

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W.E.I. Knows how to Keep this promise:

The unique combination of W.E.I. *dual worm* design and our unequalled research and development experience can solve your compounding-extruding problems with all-in-one-operation equipment . . . and *pre-prove* its *"quality-ability"* and *"rate-ability"*

● Name the most tantalizing of new plastics materials that defy the processing abilities of ordinary machines . . . They are on the success list with W.E.I. compounder-extractor-extruders. Struggle with new space-labor- and-cost problems in the material field where competition is keenest . . . and W.E.I. is on the most familiar of grounds! There are many reasons why W.E.I. has earned top priority position with those who know it pays to buy the best equipment. May we have the opportunity to discuss them with you in strictest confidence of your processes and plans?

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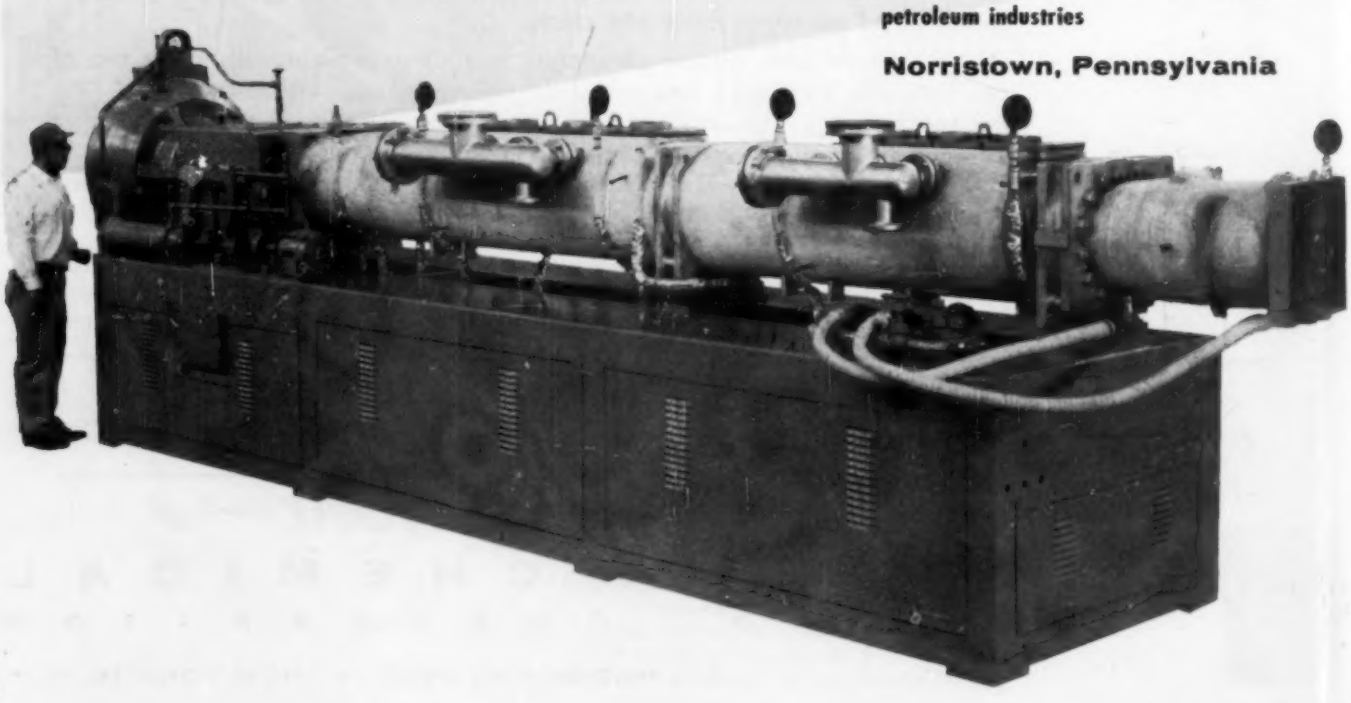
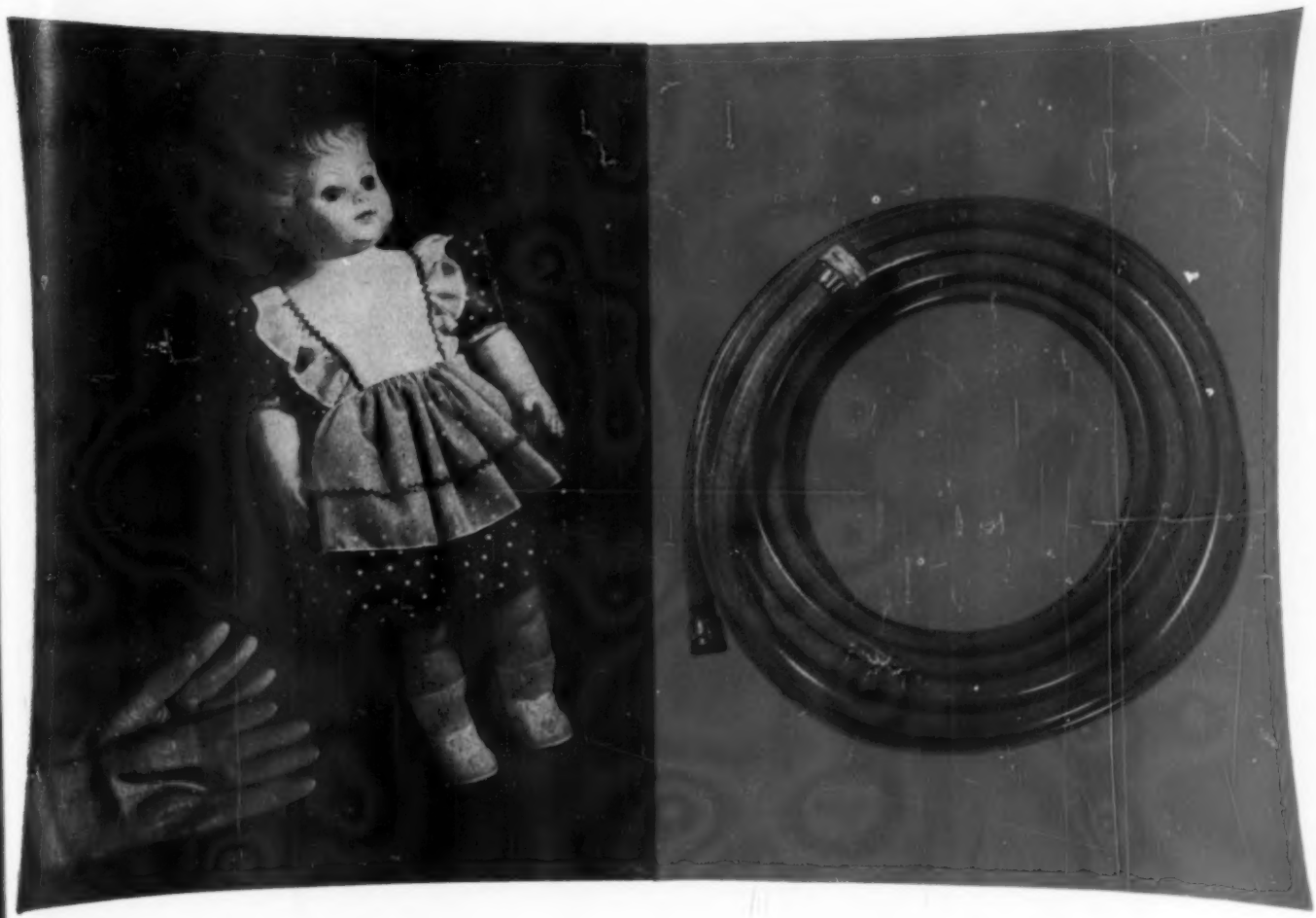


For Plastisol Moldings...or Vinyl Extrusions...



Your Best Plasticizer Buy is Still Pittsburgh PX-114

LOW *cost plus ease of processing* . . . that's the reason-in-a-nutshell why Pittsburgh PX-114 is one of the most popular of all primary plasticizers for producing plastisol moldings and vinyl extrusions!

And with PX-114, you don't have to give an inch on quality, for it provides virtually the same finished product characteristics as DOP . . . but at appreciable savings.

PX-114 exhibits excellent performance in extruded products such as garden hose, welting, gaskets and wire jacketing. It is equally well suited for use in all types of dispersions such as slush or dip moldings with plastisols.

PX-114's excellent record of price stability is a plus factor, too, when you're forecasting your overall production costs.

If you're not already acquainted with this outstanding cost-reducing plasticizer, write today for technical data, samples or the services of a Pittsburgh Industrial Chemicals man.

PITTSBURGH *Job-Rated* PLASTICIZERS

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COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

IF YOU WANT

Performance plus Economy

YOU NEED

"FLEXOL" PLASTICIZER 426

TRADE-MARK

Low price—that's the big advantage of FLEXOL plasticizer 426—UNION CARBIDE's distilled, mixed alcohol phthalate. But that's not all! This plasticizer has complete compatability with vinyl chloride resins, low specific gravity, high solvent power, and excellent heat and light stability typical of phthalate esters.

Look at these performance properties of FLEXOL 426 in BAKELITE vinyl resin QYNV:

Plasticizer Concentration, PHR	40	50	60
Durometer A Hardness	85	76	68
Elongation at 1000 psi	13%	36%	54%
Brittle Temperature	—14°C.	—22°C.	—28°C.
Loss from .004 inch film			
Volatile loss (24 Hrs. 70°C. (SPI))	7.7%	9.0%	10.3%
Water Extraction (10 days at 23°C.)	0.1%	0.2%	0.4%
Oil Extraction (10 days at 23°C.)	4.5%	9.1%	14.1%

FLEXOL 426 is an all-purpose plasticizer. Profile extrusions, electrical insulation and jacketing, vinyl flooring, calendered sheeting, and plastisols are formulated with 426.

And remember, FLEXOL plasticizer 426 is just one product in UNION CARBIDE's wide selection of plasticizers. Whatever your requirements, there's a FLEXOL plasticizer designed to do the job. For instance,

- FLEXOL DOP (di-2-ethylhexyl phthalate), the general-purpose plasticizer
- FLEXOL 10-10 (di-isodecyl phthalate), for low volatility
- FLEXOL A-26 (di-2-ethylhexyl adipate), for low-temperature performance
- FLEXOL R-2H (a polyester), for extraction resistance
- FLEXOL 380 (a monomeric phthalate), for lacquer mar resistance

This means you can take advantage of the savings due to combination truckload, carload, and bulk shipments. And, UNION CARBIDE's basic raw materials position guarantees you FLEXOL plasticizers in the quantity and quality you want—when you want them.

For more information on 426 and other FLEXOL plasticizers—write Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, New York. In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Toronto.

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